A SYSTEMATIC APPROACH TO RURAL DENTAL SERVICE PLANNING AND DEVELOPMENT

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Bachelor of Science

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Houghton, New York

1978

Submitted to the Faculty of the
Graduate College of the
Oklahoma State University
in partial fulfillment of
the requirements for
the Degree of
MASTER OF SCIENCE
December, 1987

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PREFACE

The focus of this study is rural dental health care services. The primary objective is to develop methods which will allow community leaders to evaluate their community's ability to support a dentist(s) or to allow a prospective dentist to analyze a community's dental economic potential.

I wish to express my appreciation to my major adviser, Dr. Gerald A. Doeksen, for his PATIENCE, guidance, and assistance throughout the planning stages and completion of this study. Appreciation is also expressed to the other members of my committee, Dr. Daryll E. Ray and Dr. James R. Nelson. Special thanks go to Dr. Michael D. Woods for filling in as a committee member in order to help me meet deadlines.

Lou Stackler is to be thanked for his participation in this study. I would also like to thank the many dentists who cooperated in this study. The time and data they contributed to this research is deeply appreciated.

I am grateful to Dr. James E. Osborn and the Department of Agricultural Economics for providing financial assistance and the opportunity to continue my education. Special thanks go to the Data Center and Computer Services for their help in the preparation of this dissertation. Many thanks are also due to Julie McCoy for her patience in preparing this manuscript.

My sincerest thanks go to my friends for their support and encouragement during the course of this study. In particular, I wish to acknowledge the support I received in the friendships developed with Marsha, Kitty, Tom, and Sherry. Claudia "C.J." Sersland deserves a special thank you for her friendship and support. My very patient and understanding officemate, Lucinda Worley, deserves a medal for putting up with me, to say the least!.

Finally, thank you M.W.P. for your loving support, encouragement and unfailing patience during the course of this study.

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INTRODUCTION

Need for the Study

Leaders in rural communities desire to have access to adequate dental health care services. Most often, this means having a dentist in their community. If a community committee is seeking to attract a dentist, the committee needs to know how many dentists the community can support. The committee needs to protect the dentist established in the community. If a community is expected to decline in population, then local dentists need an estimate of how many dentists the community can support. Likewise, as dental students evaluate alternative locations it is important to be able to evaluate the potential of each location.

Each dentist is faced at some point in his or her career with the decision regarding where to locate a practice. For most dentists this decision is made during or soon after graduation from dental school, and in most cases the chosen location is within their home state.

In 1982, there were an estimated 1,282 dentists in the state of Oklahoma. Although the number of actual dentists and private practitioners has increased slightly over the past ten years, the total number of active specialists has remained roughly constant. Nearly 90% of all dentists were active and 80% were in private

practice, either part-time or full-time (American Dental Association, 1984).

A leading factor in determining the location of dentists is financial concern. Although geographical tastes and preferences are important, as are the influences of family and friends, this is one "barrier" that prevents dentists from practicing in high need areas, i.e. rural areas. Williams, Wechsher, and Garfield (1969) studied dental manpower in the Boston metropolitan area. They reported that towns with low socioeconomic levels have the following characteristics in common: (1) few dentists per population; (2) few specialists; and (3) decreasing provisions for dental services. The study indicated a relationship between the economics of a community and dental manpower. The economic status of people in areas of high need is generally low.

Walsh and Elling (1968) point out that the problem arises when "the professional is to serve all who have need of his skills but in the competition for a larger share of the professional prestige pie, it may be that one way to advance is to seek to serve a higher class clientele rather than risk being identified as a servant of the poor or the lower class."

In locating a practice, the service area of existing and potential practitioners is usually the county or city in which they may locate. Although the majority of an urban dentist's pool of patients may reside within a small radius of his or her office, the rural practitioner's patient pool is dispersed over a much larger geographic area. Rural patients have to travel a greater distance to receive treatment, and many cross into an adjacent county.

A need exists for the development of a method which community leaders can use to evaluate the feasibility of their town supporting a dentist or additional dentists, and which dentists can use to evaluate a community's ability to support a practice or additional practices.

Objectives

The primary objective of this study is to develop procedures which can be used to evaluate the feasibility of a community supporting a dentist or additional dentists. More specifically, the objectives are to:

1. develop a procedure to estimate the number of dental visits per year for a service area;
2. estimate total dental capital costs;
3. estimate annual dental capital and operating costs;
4. estimate gross and net income; and
5. estimate the cost to the community of providing a facility for dental care.

By addressing these objectives, dentists will be able to evaluate the feasibility of alternative locations and community leaders will be aided in their decision to attract a dentist to their community.

Data and Survey Area

Two surveys were taken to gather the necessary data for the study. The first survey was conducted in 1984 by the Oklahoma Health Systems Agency in conjunction with the University of Oklahoma dental school. After the data was collected, it was given to Oklahoma State University to analyze and use. This was a telephone survey of 150

households in three different regions of Oklahoma. One of the objectives of the survey was to gather data on dental usage and practices. Data collected included the number of household members that visited the dentist, the number of visits by household member, total amount of dollars paid to dentists, the amount of the dental costs paid by Medicare, Medicaid, other insurance, and/or cash to the dentist.

A second survey was administered to 13 Oklahoma dentists. The second survey was conducted by Oklahoma State University with the assistance of the Oklahoma Dental Association and the University of Oklahoma Dental School. The Oklahoma Dental Association assisted in the selection of dentists to survey. The purpose of the survey was to estimate annual dental revenue, capital requirements, and annual capital and operating costs. Also, measured was the typical number of weeks worked per year. For estimation of revenue, questions were asked about type of procedure performed and amount charged for the service. Information pertaining to capital requirements included the type of building, lot size and cost, and equipment found in the dentist's office. Operating costs were estimated by the following categories: building, office, dental, and personnel. The cost information for equipment was primarily furnished from the dentists surveyed in Oklahoma. Dealers of dental equipment were contacted for additional equipment cost data. Construction costs of the building were obtained from the survey.

The dentists participating in the survey were selected on the basis of several criteria. The willingness to cooperate was of main

importance. Once this was established, the following criteria were evaluated: geographic location of the dental practice, age of the dentist, solo or group practice, and length of time in practice.

CHAPTER II

REVIEW OF LITERATURE

Introduction

The literature concerning dental services is extensive. This review is divided into five sections. The first section deals with the utilization of dental services; specifically, the factors affecting the use of dental services. The second section looks at the demand for dental services. Terminology distinctions were also made here concerning need, demand, and supply for the purpose of this study. Sections three, four, and five deal with locating a dental practice, success of a dental practice, and dental office planning, respectively.

Utilization of Dental Services

A number of investigators have discussed the factors which affect the utilization of dental services. Ettinger and Beck (1980) discussed some of the barriers and evaluated those impacts on the elderly. The problems they found were: economic, political, attitudinal, psychological, and historical. More specifically, the elderly tend to have lower health expectations of themselves, and a less positive attitude toward dental health and dental treatment. The dental profession shares the elderly's bias towards themselves and are

faced with multiple problems that create disincentive to treat them. The authors concluded that the responsibility for the dental care of the elderly lies with the general dental practitioners. They must educate themselves, their elderly patients, the community, allied health professionals, and physicians about the value of dentistry for the elderly.

Taylor and Carmichael (1980) evaluated the spatial distribution of dental services. They concluded by spatial analysis that dental health varies with the availability of and access to treatment facilities. A new general dental practice, new health center, clinic, or provision of mobile dental surgeries within areas previously poorly served was found to stimulate dormant demand and lead to marked improvements in the level of dental health.

A review and evaluation of the efforts to control dental care costs in the United States was performed by Gift, Newman and Lowey (1981). The authors concluded that the variety of cost containment approaches have been effective, but some more than others. These have been identified as programs which encourage increased responsibility on the part of the individual for his or her health; community prevention programs; and increased productivity through efficient use of auxiliaries and equipment. Other approaches identified were structural factors illustrated by Health Maintenance Organizations (i.e. peer review and methods of reimbursing providers which create incentives for efficient dental practice) and prepayment and review of benefits encouraging early dental care.

Dental attitudes were examined by Kiyak and Miller (1982) as

possible determinants of different patterns of dental service utilization. A retrospective study was conducted among 61 elderly and 58 young persons enrolled in a free dental program for low-income urban residents. Using Fishbein's attitude model (1963), normative scales of dental beliefs, effects, and importance were administered. Questions about perceived oral health and health behavior were asked. The conclusions were that, regardless of utilization behavior, low-income elderly person in this sample attributed less importance on oral health than did young persons. Elderly persons in this sample recognized poor health status and may have sought professional dental care, but knowledge and behavior were not significantly related to their attitudes or home care behaviors. Lastly, for dental service programs for the low-income elderly to be successful, they must emphasize the importance of dental care in the later years.

The effectiveness of five procedures to encourage parents of Medicaid eligible children to follow up on dental referrals was compared by Reiss and Bailey (1982). Three procedures were designed to alleviate practical difficulties that might have discouraged implementation within the health care system. An incentive procedure allowed participants to select four rewards, most of which were compatible with the goals of the health care system. A prompting procedure was designed to be economically feasible and relied upon repetitions to promote dental visits, while the problem-solving procedure was brief, simple, and easily replicated. The multiple contact and incentive plus problem-solving techniques were found significantly more effective in initiating dental visits than control

procedures. Families assigned to the intensive strategies were most likely to complete treatments. Also, a cost-efficiency analysis showed the multiple contact technique to be a low-cost and highly effective procedure.

An investigation by Yellowitz et al. (1982) examined a pilot dental care program for senior citizens providing low-income persons with an 80-20 cost sharing dental insurance plan for two years, August 1977 to August 1979. Analysis of the data revealed differences between users and nonusers, patterns of use, and differences in cost-utilization ratios for the various dental services. Findings indicated that claimants were more likely to be younger, married, and more educated and to have visited a private dentist in the last year for a check-up. They tended to have oral pain or problems with speech and/or eating and believe that the loss of teeth was not inevitable. Also, they realized the need for fillings, root canal treatment, or new dentures. Participants were more likely to be claimants if they currently had their own dentists and had been to a dentist in the preceding year. Having natural teeth increased the likelihood of becoming a claimant. Those who identified a need for an examination, cleaning, or x-rays were more likely to be claimants.

The most commonly used treatments were the simpler, less involved procedures with a lower cost. The most notable differences between the sexes were that men received more removable prosthodontic and oral surgery services, whereas women received more diagnostic, preventive, and restorative services.

Cost utilization ratios for the varying services performed ranged

from a high of 1.8 for fixed prosthodontic services to a low of 0.1 for preventive, diagnostic, periodontic, and oral surgery services. A ratio of less than 1 indicated a dental service with high utilization rates relative to the costs incurred by that service category. This was considered a "good buy" for the claimant. Conversely, a ratio greater than 1 indicated a dental service category that consumed a greater percent of the costs than might be warranted for the relatively few users of that service, which was considered a "bad buy."

A study was conducted by Davies, Bailit, and Holtley (1985) on the effect that dental disease has on the use of services and about the factors that affect this relationship. Several facts were revealed. Oral health status of the U.S. population overall is improving as a result of marked reductions in caries (tooth decay) and missing teeth. Utilization of use and average annual visits for users has remained relatively constant although the intensity of services has increased substantially and relatively large proportions of people continue to make little or no use of dental care services during a year. Also, it can be inferred that: (1) those who are in poorer oral health appear to be over-represented among the nonusers; (2) while insurance reduces utilization differences between subgroups, the more advantaged who are in better oral health continue to use more services; and (3) misperceptions of need for care may explain, in part, why people do not use dental services.

Greinbowski, Conrad, and Milgrom (1985) examined dental service utilization rates in a large insured population (1.2 million

Pennsylvania Blue Shield Dental issued) and compared these rates with those in the U.S. population. The findings indicated that annual dental insurance increased dental service utilization above national norms for most sociodemographic groups. The major beneficiary appeared to be children from low-income families and/or who have parents with little formal education. Public or private dental insurance programs were important public health measures and that dental insurance can affect both the percent of insureds visiting the dentist annually and the intensity of service received among users.

Demand for Dental Services

Those concerned with planning for health manpower attach particular meanings to the concepts of need, demand, and supply (DeFriese and Barker, 1982). Although minor distinctions are made by various contributors to the literature regarding one or more of these terms, the following broad definitions are generally accepted:

Need: a normative, usually professional judgement as to the amount and kind of health- or medical-care services required by an individual having certain characteristics in order to attain or maintain some standard level of health.

Demand: the volume and type of health-care services that an individual desires to consume of some level of price. Demand is to be distinguished from utilization, which is the volume and type of service actually consumed. When demand becomes utilization, reference is frequently made to "effective demand."

Supply: the quantity of health-care services of manpower provided or available, normally as the price of services varies. Increases in demand normally induce an increase in price; in addition, for most services, an increase in price will induce an increase in supply (Discurvice Dictionary of Health Care, 1976).

The effects of income and the fluoridation of public water

supplies on the demand for different types of dental services was examined by Upton and Silverman (1972). Data for the study were obtained by compiling records of all dental services performed in 15 midwestern towns for one week. Data were collected from dentists' records on the number and types of treatment performed during that week. All towns had water supplies with varying fluoride concentrations. The dental services were divided into several types and a demand curve was estimated for each type. Regression equations were estimated in logarithmic form. The dependent variable was the number of visits for each service. Their analysis indicated that the income elasticity of demand exceeds 1 for most dental services and that there were substantial differences in the income elasticity of demand for the different services. The income elasticity of demand for dentists was approximately equal to 2. The analysis further indicated that fluoridation of public water supplies would reduce the demand for dental services by 55 percent.

Two strategies for converting need into demand were identified by Davis (1980). The first is a utility model, a long term program, involved in raising the level of 'want', or perceived need, through attitude change. The second, a benefits model, had a more immediate impact and involved increasing the rate at which perceived needs are converted into demands by reducing organizational barriers. There is argument that potentially a quarter of the adult population is susceptible to demand expansion under the benefit model. Racial and social class differentials in perceived need would be reduced. A number of specific initiatives were suggested. First, the

retentiveness of the dental system could be increased, especially among marginal groups. This would be through the establishment of a more egalitarian clinical relationship, by the exercise of human relationship skills, through behavior strategies for increasing compliance, and through improved access. Secondly, improved geographical access could be achieved through tapping the captive populations present in two major institutional areas, the school and the work site. This requires mobility in deployment of resources and flexibility in negotiating the organization and financing of care. Finally, more rational visit schedules, organizational arrangements, and payment systems needed to be developed in the average dental practice.

Feldstein and Roehrig (1980) examined the national econometric model of the dental sector (EMODS) developed to forecast a broad range of variables in the dental sector under specific assumptions about future conditions and government policies. Variables projected were dental care spending, prices, utilization, number of dentists, income of dentists, and employment of auxiliaries. In a test of its reliability, the model forecasted dental sector behavior quite accurately for the period 1971 through 1977.

Another study to estimate dental manpower requirements was conducted by DeFriese and Konrad (1981). This was done in conjunction with the North Carolina Dental Manpower Study. Several types of data relied upon were: dental manpower supply and distributions; dental-office practice-productivity; dental manpower requirements; and patterns of consumer demand. The procedure estimated is generally

called "the health needs approach to health manpower planning." This consists of four steps: (1) determining the health stature of the community, i.e. the number and characteristics of people with specific incidences or prevalences of illness or disease are quantified; (2) the appropriate treatment of each disease and illness is specified in quantitative terms; (3) specifying the amount of time it takes for the typical practitioner to provide each service; and (4) calculate the number of hours in a year the practitioner works. Similar work was conducted by DeFriese and Barker (1982).

Evashwick, Conrad, and Lee (1982) conducted a household interview survey of 883 persons age 62 and older residing in Seattle, Washington. The survey asked about a broad range of health care and social service issues, including the need for and use of dental care. The Anderson model of health services utilization was used to identify predisposing, enabling and need characteristics hypothesized to affect the use of dental services. A path analysis was conducted to distinguish the direct and indirect effects of the variables. The results showed that none of the predisposing variables, including age was a significant factor in explaining the use of dental services. Education had both direct and indirect relationships to use. Having a regular source of dental care was also an important factor affecting utilization. Neither income nor insurance variables were powerful factors. Need, measured by an index of dental problems and having dentures, was the strongest determinant of dental care use. The model was better at predicting whether or not dental care would be sought by an older person at all (R^2 = .27) than in predicting the amount of

service used (R^2 = .06).

Using an econometric model, Hay, Bailit, and Chiriboga (1982) evaluated the determinants of demand for dental health. Using least-squares regression, dental health and dental care were jointly endogenous. The theoretical analysis was based on the application of economic theory to production activities occurring at the individual or household level. One of the key empirical findings was that the net price elasticity for dental services was very low (-0.2) for this sample of individuals with high dental insurance coverage. Demand for dental visits was found significantly and negatively relative to out-of-pocket expenses for dental care. The number of decayed teeth decreased significantly with dental visits. A number of potentially important factors were not available in the data under analysis. These included fluoride levels, nutrition, eating and smoking habits, and more precise measures of time spent in home dental care. The authors suggested that to improve the statistical reliability of the estimated model, it would be necessary to apply it to a larger and more diversified sample of individuals. Lastly, a variable measuring years of insurance coverage was not found significant in explaining dental visits and was excluded from the final model specification to reduce estimated variance.

A transitional matrix model was used by Spencer (1982) to analyze the projected supply of dentists in Australia up to 1991. The assessment of changing age distributions of dentists and the wastage rates from the supply of dentists were also included in the model. The concept underlying the study regarded the dental manpower of

Australia as a dynamic system of stocks and flows. The stock of dentists is equivalent to the current supply of active dentists. The movement of dentists into and out of this stock constitute the flow of dentists. Recruitment to the stock may be from locally trained dental graduates and from migration. Attrition of the stock may arise from emigration, pursuit of alternative careers, retirement, or death.

Estimated dental manpower needs in Michigan from 1980-2000 was conducted by Vankirk (1982). Total needs for dentists was comprised of: current dentists who will not be 65 years old by the year 2000 plus graduates of out-of-state dental schools plus graduates of in-state dental schools. McFarland (1983) presented an overview of the dental manpower in Oklahoma. The dentist to population ratio and age demographics were presented for the eight dental districts in Oklahoma. Solomon (1984) presented data highlighting dentistry's relationship to the other health professions' manpower trends up to the year 2000. Gotowka (1985) presented a similar study from 1971-1982.

A structural socioeconomic demand model for dental visits was developed by Petersen and Pedersen (1984). Structural equations were estimated by multiple regression analysis using the two-stage least-squares method. In the study, a negative effect of the price variable on dental visits was observed. Dental visits and dental health were found mutually reinforcing. Attitude variables and expectations about the value of dental care influenced the demand for dental visits positively.

Locating a Dental Practice

The selection of a practice location is a very complex procedure. Posnick and Diske (1981) examined the characteristics of a dental student population as they related to career choices. This constituted the first phase of a long-term project to investigate the variables associated with practice location. They perceived that choosing a practice location may be a process rather than a 'decision', and that this is an intricate, involved process working on several levels of consciousness with many questions remaining unanswered. The study revealed that the factors influencing the selection of practice location have been based on subjective criteria. These included encouragement of family and peers, the availability of a good location, and the feeling that the community could provide for the needs of his family. Also, the new graduates tended to settle in hign socio-economic areas and areas with high median income. Generalists had a significant tendency to practice in their hometown or communities known to them.

Several investigators have offered more systematic or objective approaches to evaluate communities for practice location. Deseker and Chappell (1977) developed a check list of several variables to consider, grouped according to personal factors, professional factors, and economic factors. Mashioff (1981) developed guidelines for establishing a new practice location. Topics covered were: allowing space for future growth, locating near public transportation, obtaining a lease, and purchasing a practice. Quinn and St. Aurault

(1982) offered an alternative approach to making decisions based on a Decision Making Guide for the Dental Graduate. It included many of the major decisions facing the dental graduate along with some important considerations. The Guide is keyed for quick reference. Coplan (1985) strongly suggests that a demographic analysis would provide a great deal of feedback about the soundness of the community and its ability to support another dental practice. A list of items is presented to help determine if the physical site of the practice is suitable once the community has been chosen. Where appropriate, some of these items can be applied to buying an established practice where a dentist is constructing a facility. Barron, Shirley, and Waldrep (1984) described an organized approach to choosing a practice site which is a modification of the systematic location analysis used by many retail businesses.

The increasing and prohibitive costs of establishing or purchasing a new practice have deterred many new graduates from the traditional one-dentist or two-dentist practice. New alternatives should be considered. Sutherland (1979) discusses the pros and cons of solo versus group private practice, i.e. associateship, partnership, and cluster practices. Kuhn (1980) discusses the concept of the satellite office. Bailit (1982), Gondela (1982), and Krauth (1982) examine various alternative delivery systems and how they operate in terms of patient freedom of choice in selecting a dentist, dentist independence in making practice decisions, dentist reimbursement, quality assessments, and the pros and cons of each system. The systems are health maintenance organizations (HMOs),

retail store dentistry, franchise dentistry, corporate dentistry, and capitation dentistry.

In the words of Webster and Packer (1981) "a variety of strategies have been used to influence the practice location decisions of health professional graduates." Among them are scholarship and loan programs sponsored by federal and state governments and state health organizations. A common feature of most of these financial aid programs is a requirement to practice in a rural or underserved area upon the completion of training.

The Southeastern Kentucky Health Professions Scholarship Program (SKHPSP) was one of these. It began in 1971 through a grant funded by the Appalachian Regional Commission. The SKHPSP was designed to provide health manpower training in 14 different health professions education programs, including dentistry.

Students were recruited from the 16 southeastern Kentucky counties comprising the Southeastern Kentucky Region. Scholarships were awarded based on financial need. Scholarship recipients agreed to return to the 16 county region to practice full-time for one year (on a month-to-month basis) for each year of financial support received. Recipients also agreed that if they did not complete their professional training or return to practice full-time in the region, the full amount of the scholarship funds awarded to them would become a no interest loan payable immediately to the program. The program was successful in demonstrating that distribution of dental manpower in rural areas can be effected in a positive manner.

Mascola (1985) discusses the Associate Program developed by the

New York State Dental Association, designed to match the graduate with the practicing dentist who provides employment. Another program is the Big Brother/Preceptorship Program. This program gives the graduating student the opportunity to visit a dental office, meet the dentist and staff, and observe chairside and practice management procedures. It gives practicing dentists the opportunity to screen graduates and formulate their specific needs in an associate.

Success of a Dental Practice

Dentistry is a behavioral science as well as a business. Many factors contribute to the success of a dental practice. The degree of satisfaction with one's work has been linked to the quality of one's life outside the work role, especially with regard to one's physical and mental health. Yablon and Rosuer (1982) conducted a study to obtain information and uncover relationships that existed between satisfaction and the practice of dentistry. The study concentrated on two areas: (1) the development of three career satisfaction scales which were overall career satisfaction, intrinsic satisfaction, and extrinsic satisfaction; (2) the relationship of the study group's age and income within these satisfaction scales. The results showed that age was not significantly related to either intrinsic or overall satisfaction, but was related to extrinsic satisfaction. Also, dentists' satisfaction increased with increasing income, but only up to a point. One interpretation of this is that dentists who are entrepreneurially-oriented may be miscast in the traditional dentist's role and that perhaps a new role for this type of dentist will emerge

from the commercial dental industry taking place today.

Dentistry is a service industry. Mitchell (1981) indicates that the marketing and delivery of professional services is a fact of life. In effect, dentistry is like any other business, seeking to identify its presence in the marketplace and attempting to make the marketplace aware of its existence and value. A shift must be made from service marketing to target marketing. That is, choose a target group, get their attention, establish a need, attempt to overcome the barriers to seeking dental care (fear, expense, accessibility, apathy, and ignorance), and provide satisfaction in the relationship. Quinn (1983) discussed some of the personal strategies which can determine the success of a dental practice in a competitive marketplace. Twelve strategies discussed in detail were change (career goals), attitude, quality, creativity, humor, leadership, objectivity, growth, challenge, vision, and accomplishment. Clemens (1984) indicated that sound management, financial procedures, and controls have become vital to the growth and sometimes to the survival of many practices which once were almost automatically successful. Two basic concepts were given: (1) the establishment of facts (data) which clearly define both the management and financial needs of the practice; and (2) the establishment of systems which respond to the defined needs. These systems must be tailored to each individual office. Two examples are: (1) a new patient tracking system can give the demographics of each new patient on a single sheet of paper or a projected business plan and/or budget can be developed several years in advance; (2) a management information system on a single sheet of paper allows firm

and visible control of daily activities and define their financial impact on the practice.

Similarly, Sauter (1985) presented six guidelines to be successful as a professional and as an individual: (1) maintain consistent, realistic goals; (2) be aware of the market environment; (3) know what motivates people; (4) establish a strategy; (5) develop a marketing plan; and (6) implement the plan and follow through.

Dental Office Planning

Time spent in careful study of design, construction, and equipping of the dental office is an investment in itself. Layman (1982) discussed the active role dentists can take in the design process of the dental office. For the dental graduate, step-by-step guidelines to selecting and financing equipment as well as to selecting and designing an office to that equipment are included. The options of purchasing and leasing office space are discussed. Included are several specific and practical design ideas to help dentists arrive at a configuration that is right for his or her specific needs.

For established dentists, building a new office and remodeling existing space is discussed. Also, a discussion of equipment selection and financing serve as a refresher course on current equipment availability.

As the literature review suggests, the research concerning the area of dental services is extensive. To summarize, it was found that barriers to utilization of dental services consisted of economic,

political, attitudinal, psychological, and historical perspectives. Dental practitioners must educate themselves, their elderly patients, the community, allied health professions, and physicians about the value of dentistry for the elderly. Dental health service was found to vary with the availability of and access to treatment facilities. Annual dental insurance increased dental utilization above norms for most sociodemographic groups.

Regarding demand, authors found that the income elasticity of demand exceeds 1 for most services. Fluoridation of public water supplies may reduce the demand for dental services by 55 percent. Dental visits and dental health were found to be mutually reinforcing. Attitudinal variables and expectations about the value of dental care influence the demand for dental visits positively. The dental practice should be viewed as a business by the dentist when considering factors regarding the location, success, and planning of a dental office.

CHAPTER III

PREDICTION OF OFFICE VISITS

Introduction

Community leaders and prospective dentists need to be able to estimate potential demand for dental services in their area. To evaluate a community's potential for supporting a dentist, an estimate of the number of dental visits an area will generate must be made. A dental visit is defined as any visit to a dentist's office for treatment or advice, including services by a technician or hygienist acting under a dentist's supervision. There are several factors that affect the number of dental visits and identifying them would be extremely helpful. Four key factors that may affect the number of dental visits are: the age of the patient, yearly household income, the amount and type of insurance coverage, and lastly, out-of-pocket expenses the patient incurs for the dental services performed. Also, guidelines will be developed to determine how many visits must be generated to support a dentist.

Data and Study Area

To investigate factors affecting the number of dental visits, a telephone survey was conducted in three regions of Oklahoma. One hundred fifty households were contacted. Information was obtained

regarding the number of members of the household who visited the dentist in the past 12 months, the charges for dental services performed, the type of insurance coverage, if any, and various demographic characteristics of the household members (i.e. age, sex, income).

The Predictive Models

Using the data obtained from the telephone survey, coefficients specifically for Oklahoma were determined to predict the number of dental visits. Two approaches were taken. The first used regression analysis, where the coefficients reflected the change in the mean of the probabilistic distribution of Y (number of visits) per unit increase in X. The second used population ratios where the coefficients were determined by averaging the number of visits per person per year given the demographic characteristics selected. Before presenting results, the regression model used in the analysis will be presented.

Regression Model Developments

A multiple regression model was constructed to measure variables which affect dental visits. The simple linear regression model assumes that the true state of stochastic interrelationships between variables can be represented by a linear equation of the following form:

$$Y_i = \alpha + \beta X_i + \Sigma_i \qquad i = 1,2,\ldots,n$$

where Y_i is a dependent variable whose variation is explained by the explanatory variables X_i, i=1,2,...,n. The stochastic disturbance

is Σ, and α and ß are the regression parameters. The subscript i refers to the i^{th} observation. The values of the variables X and Y are observable, but those of Σ are not. Y is an nxl vector of observed values on the dependent variable, X is an nxk matrix of observations on the dependent variables, ß is a kxl vector of unknown parameters, and u is an nxl vector of unknown disturbances where k is the number of explanatory or independent variables in the equation and n is the number of observations in the sample (Johnston, 1963). With least squares the estimator for ß, $\hat{ß}_i$ is chosen to minimize the sum of squared deviations of the observed values from their means. The estimator $\hat{ß}$ derived in this manner is given in the matrix form as:

$$(X^1X)^{-1} X^1Y.$$

The model yields an unbiased estimator with the lowest variance of all linear unbiased estimators when the following set of basic assumptions hold:

1. Σ_i is normally distributed;
2. $E(\Sigma_i) = 0$;
3. $E(\Sigma_i^2) = \sigma^2$; and
4. $E(\Sigma_i \Sigma_j) = 0 \quad i \neq j$.
5. Cov $(\Sigma X_j) = 0 \quad j = 1...k$

The first two assumptions state that, for each value X_i, the disturbance is normally distributed around zero. The third assumption concerns homoskedasticity and means that every disturbance has the same variance σ^2 whose value is unknown. The fourth assumption requires that the disturbances be non-autoregressive. The fifth

assumption implies that the disturbances are uncorrelated with each of the X variables. Hypothesis about the regression model may be tested and an estimate of the impact of the effect of the explanatory variable is obtained (Kennedy, 1981).

The first step was to specify the independent variables and the fundamental relationship between the independent and dependent variables. The number of dental office visits was the dependent variable. The independent variables and expected relationships are discussed next.

1. Age - the age of the consumer. The proposition exists that dental health investment declines as individuals age, and therefore, have a negative effect on the number of dental visits.

2. Income - the amount of household per capita. As income increases, there would be an expected positive relationship with services utilized per consumer.

3. Insurance - the type of insurance coverage, if any, obtained by the consumer, i.e., Medicare, Medicade, or other insurance. As the amount of insurance coverage increases, it is expected to have a positive relationship with the utilization of dental visits.

4. Out-of-pocket expenses - the amount paid directly by the individual or family member exclusive of any part paid by insurance, other person, or agency. Typically, dental office visits are inelastic with respect to price; they occur when patients are in need of intensive dental treatment.

Given the general relationships, the variables selected, and the

data, it was possible to define an equation to be examined. The functional form was:

VISITS = f(AGE, SEX, AMTDME, AMTDMD, AMTINS, AMOUNT, I1, I2, I3)

where:

VISITS = number of household member dental visits per dentist per year

AGE = age of household member

SEX = dummy variable to indicate gender
SEX = 1 if male or SEX = 0 if female

AMTDME = the amount of total dental fees paid by Medicare

AMTDMD = the amount of total dental fees paid by Medicade

AMTINS = the amount of total dental fees paid by other insurance

AMOUNT = the amount of total dental fees paid by cash

INCOME = dummy variables to indicate total household income where:

I1 = 1 if income < $12,000

0 otherwise

I2 = 1 if income is $12,000 - $19,999

0 otherwise

I3 = 1 if income is > 20,000

0 otherwise.

Given this equation, it was necessary to specify the type of functional relationship to examine. Since the data obtained fell under the category of social science variables, and inspection of the data itself failed to suggest a clear alternative to the straight line model, a linear relationship was selected for analysis.

The stepwise maximum R^2 improvement (MAXR) technique was used for estimation. Not all of the independent variables in the original

specification performed well in the full regression. Hence, MAXR was used to select alternative model specifications which included subsets of the original set of independent variables. MAXR looks for the "best" one-variable model, the "best" two-variable model, and so forth.

The MAXR method begins by finding the one variable model producing the highest R^2. Then another variable, the one that would yield the greatest increase in R^2, is added. Once the two-variable model is obtained, each other variables in the model is compared to each variable not in the model. For each comparison, MAXR determines if removing one variable and replacing it with the other variable would increase R^2. After comparing all possible switches, the one that produces the largest increase in R^2 is made. Another variable is then added to the model, and the comparing-and-switching process is repeated to find the "best" two-variable model, and so forth.

The difference between the stepwise technique and the maximum R^2 improvement method is that all switches are evaluated before any switch is made in the MAXR method. In the Stepwise method the "worst" variable may be removed without considering what adding the "best" remaining variable might accomplish (SAS User's Guide, 1985).

Regression Results

Given the function, several models were presented in the stepwise-MAXR analysis. The "best" model resulted in an R^2-value of .28, indicating that the model explained 28 percent of the variability in the dependent variable. However, the model contained only one variable which was significant at the 10 percent level on the basis of

t-tests. In addition, all of the signs of the parameters were not in agreement with the hypothesized relationships.

The following model was determined to be the most useful in explaining the number of dental visits at the .20 level of significance.

$$\underset{\quad}{\text{VISITS}} = \underset{(11.88)}{1.9929} + \underset{(1.38)}{0.0051}\ \text{AGE} + \underset{(1.58)}{0.00028}\ \text{AMTINS}$$

$$+ \underset{(10.05)}{0.00151}\ \text{AMOUNT} - \underset{(-2.04)}{0.4915}\ \text{I1}$$

The t-values obtained in the analysis are reported in the parenthesis below the estimated coefficients. Although use of a selection technique like MAXR makes hypothesis testing suspect, the t-values are used to test the statistical significance of the regression coefficients. The t-values at the .20 level of significance for the intercept and coefficients indicate a rejection of the null hypothesis that the values are equal to zero.

The F-ratio for the model is 35.08. A test of significance utilizing this value indicates rejection of the hypothesis that $B_2 = B_3 = B_4 = 0$ for the overall model.

Population Ratios

The second method devised to estimate dental visits is simply deriving a ratio of dental visits to population. The ratio is defined as:

$$Y = \frac{\text{number of visits}}{\text{number of population}}$$

where:

Y = dental visits per person per year;

number of visits = total number of visits for the population studied; and

number of population = total number in our sample size.

Utilization rates determined by population ratios were:

All Persons:		2.36
Sex:	Male	2.38
	Female	2.35
Age:	<17	2.25
	17-44	2.36
	45-64	2.43
	65+	2.41

The utilization rates for all persons can be interpreted as the mean visit rate of 2.36 visits per person per year. In other words, the average person would visit the dentist at least 2.36 times per year.

Utilization rates derived from national dental surveys are also available and can be compared to the Oklahoma rates. Listed in Table 1 are rates from the latest national dental survey. All rates are much lower. The difference between rates can be explained partially by considering when they were taken. The Oklahoma data were based on a 1986 survey, whereas the national survey was taken in 1981.

To use these results for estimating local dental office visits, the service area population should be broken down by age and/or sex if possible. Then the respective utilization rates are multiplied by the population in each category, and the total visits are summed. It should be noted that not all of these visits will necessarily be made locally. Some may go to specialists who tend to reside in regional population centers.

TABLE 1

DENTAL VISITS PER PERSON BY CHARACTERISTIC, 1981

Characteristic		Visits Per Person Per Year 1981
All Persons:		1.7
Age:	<17	1.6
	17 - 44	1.7
	45 - 64	1.8
	65+	1.5
Sex:	Male	1.6
	Female	1.8
Income:	<7,000	1.1
	7,000 - 9,999	1.3
	10,000 - 14,999	1.4
	15,000 - 24,999	1.7
	25,000+	2.2
Geographic Region:	Northeast	2.0
	North Central	1.7
	South	1.5
	West	1.7

Source: National Health Interview Survey.

Estimating the Number of Local Visits Needed to Support a Practice

Once the potential number of local dental office visits is estimated, a method is needed to determine the number of dentists that the area can support. In order to do this, the average annual number of office visits for established dentists must be examined. Data in Table 2 show the mean number of office visits per year in 1986 for the United States. The mean number of annual office visits is determined to be 3,532.0 for all solo general practitioners, 4,282.4 visits per year for those employing hygienists, and 2,722.2 for those not including hygienist appointments.

Data in Table 3 reflect the mean number of annual office visits for rural Oklahoma dentists obtained from a survey of 13 dentists. The average annual number of office visits for all dentists was 2,948. For those employing hygienists, the average was 3,442 and for those not employing hygienists, the average was 2,256. The sample is small, but it does infer that Oklahoma dentists see fewer patients annually compared to the national averages.

To determine the number of dentists an area can support, the potential number of local office visits must be generated. Either the regression or ratio method may be used. This number of office visits is then divided by the selected number of annual visits (either the Oklahoma or U.S. survey) to determine an estimate of the number of dentists an area can support. This is discussed further in the Application chapter.

TABLE 2

SOLO DENTISTS--MEAN NUMBER OF APPOINTMENTS AND PATIENT VISITS PER YEAR, 1985

	Type of Dentist	
	General Practitioner	Specialist
All Dental Appointments (Includes Dentists Who Do and Do Not Employ Hygienists)		
Appointments Scheduled	3,406.3	4,777.3
Walk-In Visits	113.6	125.7
Emergency Visits	201.4	202.5
Scheduled Visits Treated	3,210.8	4,487.8
Total Visits Per Year	3,532.0	4,793.8
No-Shows	194.6	268.3
Appointments--Dentists Who Employ Hygienists		
Appointments Scheduled	4,231.7	4,276.0
Walk-In Visits	91.0	89.9
Emergency Visits	222.8	220.2
Scheduled Visits Treated	3,961.4	4,000.1
Total Visits Per Year	4,282.4	4,318.8
No-Shows	268.1	273.8
Appointments--Dentists Who Do Not Employ Hygienists		
Appointments Scheduled	2,531.6	4,496.8
Walk-In Visits	113.6	125.7
Emergency Visits	201.4	202.5
Scheduled Visits Treated	2,403.7	4,234.8
Total Visits Per Year	2,722.2	4,347.5
No-Shows	127.9	243.7

Source: American Dental Association, 1986 Survey of Dental Practice.

TABLE 3

MEAN NUMBER OF ANNUAL DENTAL OFFICE VISITS,
RURAL OKLAHOMA, 1986

	Average[a]	Range[b]	
		Low	High
All Dentists	2,948	1,837	4,059
Dentists With Hygienists	3,442	2,244	4,640
Dentists Without Hygienists	2,256	1,890	2,622

Source: Oklahoma Survey Data.

[a]Based on a 48-week work year.

[b]Defined as within one standard deviation of the mean.

CHAPTER IV

ESTIMATING GROSS INCOME, ANNUAL EXPENSES AND NET INCOME

Introduction

Net income is the difference between gross income and total costs. Therefore, it is necessary to first estimate gross income and total costs before expected net income can be determined. In the following sections, total revenue and costs are estimated in order to determine net income. These procedures are later used to determine the feasibility of establishing a new dental practice.

Estimating Gross Income

Gross income equals the amount of dental services provided multiplied by the price charged for these services. Consequently, the data necessary to predict gross income of a dental practice include the type of service rendered, and estimates of the rates charged for these respective services. A dentist performs a multitude of services, but income can most easily be estimated by averaging all types of services rendered to find an average charge per visit.

Data presented in Table 4 present average rates charged for various dental services performed as determined by the survey of rural

TABLE 4

REPRESENTATIVE RATES CHARGED BY RURAL OKLAHOMA DENTISTS FOR MAJOR CATEGORIES OF DENTAL VISITS, 1986[a]

Type of Visit	Average	Lower Rate[b]	Upper Rate[b]
	----------Dollars----------		
Clinical Oral Examination			
Initial oral exam	18.20	8.50	27.90
Periodic oral exam	12.60	10.00	15.20
Emergency oral exam	18.00	12.20	23.80
X-Rays			
Individual	6.30	3.50	9.10
4 Bitewing	20.00	20.00	20.00
Full-mouth	40.00	31.00	49.00
Dental Prophylaxis			
Adults	27.90	25.90	29.90
Children	21.00	16.70	25.30
Flouride Treatment	11.50	6.40	16.60
Extraction (simple)	31.10	20.90	41.30
Silver Restoration			
1-surface amalgam	28.90	25.40	32.40
2-surface amalgam	40.00	36.20	43.80
3-surface amalgam	57.00	41.80	72.20
1-Surface Composite Restoration	36.50	23.60	49.40
2-Surface Composite Restoration	43.30	38.60	48.00
Full Gold Crown	335.60	272.90	398.30
Porcelain With Metal Crown	332.60	283.30	381.90
Crown or Bridge Service	342.10	298.40	385.80
Complete Upper and Lower Dentures	795.50	706.80	884.20
Gingival Treatment (per quadrant)	49.90	31.70	68.10

TABLE 4 (Continued)

Type of Visit	Average	Lower Rate[b]	Upper Rate[b]
	----------Dollars----------		
Root Canal			
1 canal	175.20	154.50	195.90
2 canals	209.60	192.40	226.80
3 canals	250.90	227.90	273.90

Source: Oklahoma Survey Data.

[a]More detailed information is given in Appendix A.

[b]Defined as within one standard deviation of the mean.

TABLE 5

DENTAL FEES: NATIONAL AVERAGE 1986, 1985

Procedure	1986	1985
Initial oral exam (adult)	$ 17	$ 17
Panoramic film	32	31
Full-mouth X-rays	39	36
Initial prophylaxis (single procedure)	27	26
Initial Appointment (child)		
Exam	14	13
Prophylaxis	19	19
Bitewing	14	13
Flouride	12	12
1-surface amalgam	28	26
2-surface amalgam	39	37
Adult Recall		
Exam	12	12
Prophylaxis	27	25
Bitewing	14	13
Flouride	12	12
1-surface amalgam	28	26
2-surface amalgam	39	37
3-surface amalgam	49	46
1-surface composite restoration	34	32
2-surface composite restoration	48	44
Full gold crown	356	343
Porcelain with metal crown	355	338
Stainless steel crown	81	80
Post and core	98	93
Recement crown	24	21
Cosmetic bonding (eg, tetracycline stain)	103	90
Emergency exam with I and D	37	34
Extraction	33	32
Root canal (1 canal)	176	166
Root canal (2 canals)	223	210
Root canal (3 canals)	290	273
Quadrant scaling and curettage	57	54
Complete upper or lower denture	482	461
Maryland bridge	467	448

Source: Dental Management, February 1987.

TABLE 6

DENTAL FEES BY PRACTICE LOCALE, 1986

Procedure	Metropolitan Area	Small City	Small Town/ Rural Area
Initial oral exam (adult)	$ 19	$ 18	$ 14
Panoramic film	33	33	31
Full-mouth X-rays	40	39	36
Initial prophylaxis	29	28	25
Initial Appointment (child)			
Exam	14	13	12
Prophylaxis	21	19	17
Bitewing	13	13	11
Flouride	13	15	11
Adult Recall			
Exam	13	12	11
Prophylaxis	29	27	24
Bitewing	15	14	12
Flouride	13	13	11
1-surface amalgam	30	27	26
2-surface amalgam	42	39	35
3-surface amalgam	53	49	44
1-surface composite restoration	38	34	31
2-surface composite restoration	53	48	41
Full gold crown	378	361	329
Porcelain with metal crown	377	362	326
Stainless steel crown	88	83	73
Post and core	108	98	86
Recement crown	24	23	24
Cosmetic bonding	118	103	84
Complete upper or lower denture	532	476	428
Emergency exam with I and D	43	38	29
Extraction	36	35	29
Root canal, 1 canal	190	179	157
Root canal, 2 canals	241	233	197
Root canal, 3 canals	312	301	258
Complete upper or lower denture	532	476	428
Quadrant scaling and curettage	60	62	49
Maryland bridge	502	454	431

Source: Dental Management, February 1987.

TABLE 7

GROSS REVENUE FOR RURAL OKLAHOMA DENTISTS, 1986[a]

	Average	Range[b]	
		Low	High
All Dentists	$178,053	$117,043	$239,063
Dentists With Hygienists	205,038	142,180	267,896
Dentists Without Hygienists	140,274	109,368	171,180

Source: Oklahoma Survey Data.

[a]Based on a 48-week work year.

[b]Defined as within one standard deviation of the mean.

TABLE 8

SOLO DENTISTS' PRIMARY PRACTICE GROSS INCOME BY REGION, 1985

Region	All Solo Dentists	Solo General Practioners	Solo Specialists
	----------Mean----------		
New England[a]	$143,430	$136,700	$ --
Middle Atlantic	144,050	133,300	207,530
East North Central	182,020	168,170	286,500
West North Central[a]	150,630	148,110	--
South Atlantic	202,290	187,690	300,040
East South Central[a]	177,190	165,090	--
West South Central	201,370	190,590	240,070
Mountain[a]	194,270	191,130	--
Pacific	205,120	194,750	267,550

Source: American Dental Association, 1986 Survey of Dental Practice.

[a]Gross income was not reported for specialists in New England, West North Central, East South Central, and Mountain regions due to the small number of responses in these areas. The number of responses were insufficient to ensure reliable statistical results.

Oklahoma dentists. In addition, a range defined as one standard deviation of the mean is specified for each rate.

Office charges are determined by type of visit and the services performed. From the Oklahoma survey data, the average charge per visit was $61.38. Using data from the 13 dentists surveyed, this figure was computed by totalling gross revenue for a week of visits and then dividing by the number of visits per week the dentists received. The charge per visit ranged from a low of $54.53 to a high of $68.23. Data in Tables 5 and 6 show the national average of dental fees for 1985 and 1986; and dental fees by practice location. The survey data of rural Oklahoma dentists support the national averages.

By using the estimates of the number of dental office visits and the average charge per visit, estimates of gross income can be made. Individuals using this data should consider that less than a 100 percent collection rate is realistic. The estimates of gross income, when used with the cost estimates which follow, can allow a dentist to approximate his/her net income at various collection rate levels. Data in Table 7 reflect the estimated gross revenue for rural Oklahoma dentists in 1986. Table 8 contains data which show gross income by region for 1985. Oklahoma is in the West South Central region. Further details of the rate schedule can be found in Appendix A.

Estimating Total Costs

Total cost encompasses capital and operating costs. Capital costs include the investment in durable assets such as land, buildings, and equipment. Operating costs are those costs incurred as dental services are provided.

Capital Costs

The major capital costs in a rural dental practice are building, land, and equipment. Each are discussed below.

Building. Building costs are the investments made in the actual structure which houses the dental practice. Approaches to facility development may take on several forms: (1) conventional architectural design and competitive bid; (2) design and construction by the same firm; (3) modular construction; (4) renovation of existing structure; and (5) lease.

The most common type of structure found was that of conventional construction of a permanent building. Construction costs are quoted in terms of dollars per square foot. The cost per square foot in April of 1987 averaged $55. This excluded the cost of land and parking facilities. A summary of building data is presented in Table 9. The average square footage utilized per dentist was 1,255. This included the reception area, business office, dentist's office, operatories, laboratory, and darkroom.

Equipment. Data in Table 10 present the survey results on equipment found in rural dental offices by location in the office and the percent of those respondents having said equipment. This information could be used by community leaders to develop a list of equipment needed for a dental office. They could investigate the cost of equipping an office with equipment found in at least 50 percent of the responses.

While this procedure identifies the type of equipment, it is also

TABLE 9

DATA ON BUILDING AND GROUNDS UTILIZED
BY RURAL OKLAHOMA DENTISTS, 1986

Item	Number of Observations	Average	Range	
			Low	High
Square Feet Utilized per Dentist	12	1,255	550	2,400
Construction Cost per Square Foot[a]		55.00	40.00	90.00
Land[b]				
Parking Lot[c]	3	--	1,800	40,000

Source: Oklahoma Survey data, except as noted in footnotes a and b.

[a]Facilities built in 1987. Data obtained from construction companies.

[b]Local land prices should be used.

[c]The large range includes a variety of options from gravel to concrete. Not all offices will necessarily need a parking lot.

TABLE 10

EQUIPMENT FOUND IN DENTAL OFFICES BY ROOM AND PERCENT OF RESPONDENTS INDICATING ITS PRESENCE, RURAL OKLAHOMA, 1986

0 to 25%	25% to 50%	50% to 75%	75% to 100%
	Reception Room		
Television	Sofa	Magazine racks	Pictures/Paintings
Bulletin board	Plants	End tables	Lamps
Wall clock	Toys	Occasional tables	Chairs
Fireplace/screen	Childrens books/Magazines		
Posters			
Tapestry			
Utility cart			
Mirrors			
Table/chairs for children			
Coat rail			
Display rack			
	Business Office		
Storage cabinets		Telephone answering machine	Adding machine
Word processor/computer			File cabinets
Straight chairs			Typewriter
Copy machine			Wastebasket
			Desk
			Chairs, desk
			Staples, clips, etc.

TABLE 10 (Continued)

0 to 25%	25% to 50%	50% to 75%	75% to 100%
	Operatories		
Dento-dri	Air and gas valves	Cabinet (portable)	Assistant stool
Dento-drain	Cleaner, autoclave/chemiclave	Cabinets (modular) group	Autoclave/chemiclave
Hydrocollid conditioner (incl. syringes)	Cleanser, high volume evacuation (1 box)	Operating light (unit mounted)	Compressor
Television	Contra angle (engine driver) (standard or peds)		Contra angle (air)
Audio-video equipment	Electrosurg		Dental chair
	Handpiece (engine driven)		Emergency oxygen unit
	Instrument sharpener		Oxygen cylinder & contents for above
	Operating light (ceiling mounted, single)		Handpiece, straight (air driven)
			Electric amalgamator
			Music system
			Nitrous oxide sedation unit, central gas supply system required
			Operating lightbulb (spare)
	Laboratory		
Air blowgun with quick disconnect	Burnout oven	Articulators	Articulators, adjustable
Electric welder (for orthodontic procedures)	Casting machine	Benches	
	Clasp surveyor	Fire extinguisher	
	Dust collector	Gas/air torch	
	Gram weight scale	Laboratory engine (includes handpiece)	
	Glass measuring graduates,cc	Laboratory light (bench)	
	Handpiece laboratory (belt driven)		

TABLE 10 (Continued)

0 to 25%	25% to 50%	50% to 75%	75% to 100%
	Laboratory chair (not stool)		
	Laboratory stool		
Staining, glazing furnace (opt.)	Laboratory work bench, fireproof, consisting of stainless steel sink; plaster trap; air, gas model trimmer valves	Plaster bin	Lathe
Vacuum investing machine			Model trimmer
			Polishing hood w/ removable pan
	Work pans, metal or plastic		Vibrator
	Darkroom		
Low kVp (50 kVp)	High kVp (90 kVp)	Intermediate kVp (70 kVp)	Safe light
Film dispenser (1 per operatory)	Developing tank (temperature regulator)	Darkroom timer	
Film projector magnifier	Film clips (1 box 12)	Intra-oral x-ray processor	
Magni-focuser	Film duplicator		
Extra oral x-ray processor	Film hangers		
	Laboratory apron		
	Dentist's Office		
Misc. desk accessories	Closets	Book shelves	Desk
Calculator/adding machine		Lamps	Chair, desk
Floor mats			
Credenza			
Pictures			
Wall hanging			
Plaques			
File cabinet			

TABLE 10 (Continued)

0 to 25%	25% to 50%	50% to 75%	75% to 100%
Type table			
Refrigerator			
Waste basket			
	Other Considerations		
Central vacuum system			
Restroom accessories			
Vacuum cleaner			

Source: Oklahoma Survey Data.

necessary to determine the amount of such equipment to provide. Data in Table 11 are the average number of specific pieces of equipment found in dental practices. This table was constructed by choosing the most frequent types and amounts of equipment that were given as a response for dental offices in the survey of rural dental offices.

Community leaders can now determine the price of equipment to estimate equipment cost. Dealers of dental equipment were contacted to arrive at average, low, and high estimates, presented in Table 12. Using price data and equipment needs, an estimate of equipment costs can be derived. Appendix C contains costs of equipment and supplies too numerous to include here.

Combining the estimate of land and building costs with the value of equipment will provide the calculation of total capital cost.

Operating Costs

Operating costs in a dental practice are expenditures incurred in the provision of dental services. For a rural dental practice, these costs are grouped into building, office, dental, and personnel. If a building is rented, monthly rent is a major component of building operating costs as shown in Table 13. Average rent was $753 where bills were paid and $700 where bills were not paid.

Building. The major components are utilities, maintenance, janitorial, and taxes. Based on the survey of rural Oklahoma dental practices, the average response for such costs per year are presented in Table 14. Electricity/gas costs were found to be a function of the size of the clinic. Insurance, at replacement cost, is given for the

TABLE 11

TYPICAL EQUIPMENT FOUND IN A DENTAL PRACTICE, RURAL OKLAHOMA, 1986

Reception Room	Dentist Office	Business Office
1 end table	2 bookshelves	1 adding machine/calculator
1 magazine rack	3 chairs	2 chairs, secretaries
1 occasional table	1 desk	1 copy machine
7 single chairs	1 file cabinet	2 desks
	1 telephone	3 file cabinets
		1 telephone
		1 telephone answering machine

Operatories	
3 assistant stools	1 emergency oxygen unit
1 autoclave/chemiclave	1 oxygen cylinder and contents for above
2 cabinet (portable)	2 handpiece (engine driven)
2 cabinet (modular) group	4 handpiece, straight (air driven)
1 cleanser, autoclave/chemiclave	1 hydrocolloid conditioner (includes syringes)
1 cleanser, high volume evacuation (1 box)	1 instrument sharpener
1 compressor	1 music system
6 contra angle (engine driven) (standard or pedo)	1 nitrous oxide sedation unit, central gas system required
2 contra angle (air)	2 operating light bulb (spare)
3 dental chair	3 operating light (unit mounted)
1 dento-dri	or
1 dento-drain	3 operating light (ceiling mounted single)
2 electric amalgamator	
1 electrosurg	

Laboratory	
1 air blowgun with quick disconnect	1 laboratory light (bench)
4 articulators	1 laboratory stool
1 articulator, adjustable	1 laboratory work bench, fire proof consisting of stainless steel sink; plaster trap; air, gas, model trimmer valves
1 bench	
1 burnout oven	
1 casting machine	1 lathe
1 clasp surveyor	1 model trimmer
1 dust collector	1 plaster bin

TABLE 11 (Continued)

1 electric welder (for orthodontic procedures)	1 polishing hood with removable pan
1 fire extinguisher	1 safety glasses
1 gas/air torch	1 staining, glazing furnace (opt.)
1 gram weight scale	1 vacuum investing machine (opt.)
1 glass measuring graduates, cc	1 vibrator
1 handpiece laboratory (belt driven)	20 work pans, metal or plastic
1 laboratory chair (not stool)	
1 laboratory engine (incl. w/ handpiece)	

Darkroom

2 intermediate kVp (70kVp) or	1 film projector magnifier
2 high kVp (90kVp)	1 film receptacle
1 darkroom timer	3 intensifying screen and cassette
1 developing tank (temperature regulator)	1 laboratory apron
1 film clips (1 box 12)	1 magni-focuser
2 film dispenser (1 per operatory)	1 safe light
1 film duplicator	1 x-ray processors
10 film hangers	X-ray processors
	1 intra-oral
	or
	1 extra-oral

Source: Oklahoma Survey Data.

TABLE 12

COST OF EQUIPMENT TYPICALLY FOUND IN DENTAL PRACTICES, RURAL OKLAHOMA, 1986

Equipment Type	Number of Observations	Average Price	Range	
			Low	High
		----------Dollars----------		
Reception Area				
Chairs, single	12	105.00	50.00	185.00
Magazine rack	7	64.00	15.00	70.00
End table	8	125.00	50.00	225.00
Occasional table	10	129.00	70.00	250.00
Business Office				
Calculator/adding machine	11	99.00	60.00	150.00
Chairs, secretarial	13	136.00	60.00	300.00
Copy machine	2	700.00	--	--
Desk	11	445.00	--	--
File cabinet	11	275.00	100.00	350.00
Telephone[a]	13	135.00	60.00	185.00
Telephone answering machine	4	200.00	50.00	400.00
Typewriter	12	1,018.00	225.00	2,500.00
Wastebasket	12	13.00	3.00	20.00
Dentist's Office				
Bookshelf	9	148.00	45.00	300.00
Chair	13	282.00	75.00	650.00
Desk	13	364.00	250.00	600.00
File cabinet	1	100.00	--	--
Telephone	2	165.00	153.00	180.00

TABLE 12 (Continued)

Equipment Type	Number of Observations	Average Price	Range	
			Low	High
		----------Dollars----------		
Operatories				
Assistant stool	11	334.00	150.00	655.00
Autoclave/chemiclave	11	1,260.00	500.00	1,600.00
Cabinet (portable)	8	812.50	200.00	1,250.00
Cabinet (modular) group	8	2,466.00	500.00	7,000.00
Cleaner, autoclave/chemiclave	5	22.50	18.00	27.00
Cleanser, high volume evacuation (1 box)	6	18.00	15.00	21.00
Compressor	12	1,315.00	700.00	2,975.00
Contra angle (engine drive) (standard or pedo)	5	70.00	50.00	75.00
Contra angle (air)	11	490.00	350.00	600.00
Dental chair	12	2,650.00	750.00	5,000.00
Dento-dri	4	352.50	255.00	450.00
Dento-drain	2	45.00	--	--
Electric amalgamator	12	275.00	150.00	500.00
Electrosurg	6	360.00	200.00	500.00
Emergency oxygen unit	11	141.00	110.00	320.00
Oxygen cylinder and contents for above	9	70.00	--	--
Handpiece (engine driven)	4	302.00	185.00	419.00
Handpiece, straight (air driven)	10	445.00	275.00	600.00
Hydrocolloid conditioner (incl. syringes)	2	42.95	--	--
Instrument sharpener	5	162.50	125.00	200.00
Music system	12	550.00	100.00	1,000.00
Nitrous oxide sedation unit, central gas system required	10	960.00	200.00	2,500.00
Operating light bulb (spare)	11	25.00	10.00	35.00
Operating light (unit mounted)	7	679.00	500.00	858.00
or				
Operating light (ceiling mounted, single)	5	783.00	400.00	1,200.00

TABLE 12 (Continued)

Equipment Type	Number of Observations	Average Price	Range	
			Low	High
		----------Dollars----------		
Laboratory				
Articulators	8	82.50	65.00	100.00
Articulators, adjustable	10	267.00	150.00	700.00
Benches	8	700.00	400.00	1,000.00
Burnout Oven	5	450.00	250.00	700.00
Casting machine	4	287.50	175.00	400.00
Clasp surveyor	6	193.75	75.00	350.00
Dust collector	6	187.50	125.00	250.00
Electric welder (for orthodontic procedures)	5	600.00	--	--
Fire extinguisher	9	33.00	10.00	50.00
Gas/air torch	7	70.00	50.00	130.00
Gram weight scale	4	52.50	30.00	75.00
Glass measuring graduates, cc.	6	5.83	2.00	8.50
Handpiece laboratory (belt driven)	6	255.00	100.00	600.00
Laboratory chair (not stool)	4	67.50	50.00	85.00
Laboratory engine (incl. w/ handpiece)	8	443.75	275.00	650.00
Laboratory light (bench)	8	67.00	50.00	75.00
Laboratory stool	6	87.50	--	--
Laboratory workbench, fireproof, consisting of stainless steel sink; plaster trap; air, gas, model trimmer valves	4	1,500.00	--	--
Lathe	12	182.00	100.00	200.00
Model trimmer	10	307.00	150.00	500.00
Plaster bin	8	150.00	100.00	250.00
Polishing hood w/ removable pan	11	167.50	110.00	225.00
Safety glasses	6	62.50	50.00	75.00
Staining, glazing furnace (opt.)	3	600.00	500.00	700.00

TABLE 12 (Continued)

Equipment Type	Number of Observations	Average Price	Range	
			Low	High
		----------Dollars----------		
Vacuum investing machine (opt.)	3	350.00	300.00	400.00
Vibrator	11	104.00	75.00	125.00
Workpans, metal or plastic	6	11.00	6.00	20.00
Darkroom				
Intermediate kVp (70 kVp) or	9	2,640.00	1,400.00	3,500.00
High kVp (90 kVp)	5	4,433.00	1,000.00	6,000.00
Darkroom timer	7	10.00	5.00	15.00
Developing tank (temperature regulator)	6	275.00	250.00	300.00
Film clips (1 box 12)	4	24.00	12.50	50.00
Film dispenser (1 per operatory)	3	48.00	--	--
Film duplicator	4	158.00	125.00	200.00
Film hangers	5	15.00	5.00	25.00
Film projector magnified	3	--	--	--
Film receptacle	3	30.00	--	--
Intensifying screen and cassette	4	110.00	60.00	184.45
Laboratory apron	3	21.00	--	--
Magni-focuser	--	--	--	--
Safe light	10	55.00	30.00	100.00
X-ray processor				
Intra-oral or	8	2,035.00	940.00	3,500.00
Extra-oral	2	2,387.50	--	--

Source: Oklahoma Survey Data.

[a]Telephone cost represents the cost of an individual telephone unit, not a system cost.

TABLE 13

AVERAGE AND RANGE OF MONTHLY PAYMENTS BY RURAL OKLAHOMA DENTISTS FOR OFFICE FACILITIES 1986

Facility	Number of Observations	Average	Range	
			Low	High
		----------Dollars---------		
All Observations	13	712	450	850
Facility Community Owned	0	-	-	-
Facility Privately Owned				
Bills Paid	4	753	651	800
Bills Not Paid	9	700	650	850

Source: Oklahoma Survey Data.

TABLE 14

AVERAGE ANNUAL BUILDING OPERATING COSTS,
RURAL OKLAHOMA, 1986

Item	Number of Observations	Average	Range	
			Low	High
		----------Dollars Per Unit----------		
Electricity and Gas	9	2.39 /sq. ft.	1.40	4.38
Water, Sewer, Trash	6	643.00 /dentist	140.00	1,610.00
Maintenance	4	1,140.00 /dentist	321.00	2,137.00
Janitor	8	1,763.00 /dentist	600.00	2,835.00
Taxes	7	924.00 /dentist	135.00	3,800.00

Type of Building	Cost per $100 Value[a] (replacement cost)	
	Building	Contents
Concrete-Brick Veneer	.685	.115
Frame	.87	.115

Source: Oklahoma Survey Data, except where noted in footnote a.

[a]Data obtained from local insurance companies.

building and contents per $100 value and type of structure (concrete or frame). The remaining building costs are given on a per dentist basis. For example, annual maintenance costs averaged $1,140 per dentist.

Office. Office expenses are incurred in the operation of the dentist's business office. Average annual expenses, as determined in the survey of rural dentists, are given per dentist per year in Table 15. Expenses for office supplies are a function of the number of office visits. However, in our survey, office supplies, office equipment, and billing were combined due to the variation of responses.

Dental. Dental costs can be categorized by dental equipment, maintenance, dental supplies, and malpractice insurance. Data in Table 16 present average costs of such outlays per dentist per year. For example, malpractice insurance averaged $1,448 per dentist. Dental supplies, similar to office supplies, are a function of the volume of office visits. Due to the variation in responses to the survey, dental supplies included laboratory fees and equipment and could not be determined separately.

Personnel. Labor in a dental practice can typically be divided into dental personnel and support personnel. There exists some variation in the types of personnel employed in these categories. Data in Table 17 detail average salaries and their ranges by job title and/or qualifications found in the survey of rural dental offices. A review of the data in this table shows that the average annual salary

TABLE 15

AVERAGE ANNUAL OFFICE OPERATING COSTS,
RURAL OKLAHOMA, 1986

Cost Category	Number of Observations	Dollars per Dentist		
		Average	Range	
			Low	High
Telephone	11	1,782.00	970.00	3,291.00
Office Supplies, Office Equipment, and Billing	11	4,138.00	1,100.00	8,000.00
Professional Services[a]	5	3,205.00	600.00	5,600.00
Auto Expenses	7	1,383.00	500.00	2,587.00
Convention	8	2,356.00	300.00	5,000.00
Professional Dues	11	1,137.00	550.00	1,740.00

Source: Oklahoma Survey Data.

[a]Lawyer, Accountant, CPA, Practice Management Consultant, etc.

TABLE 16

AVERAGE DENTAL OPERATING COSTS,
RURAL OKLAHOMA, 1986

Cost Category	Number of Observations	Dollars per Dentist		
		Average	Range	
			Low	High
Dental Equipment Maintenance	5	703	200	1,265
Dental Supplies (includes lab fees and equipment)	11	13,580	500	27,000
Malpractice Insurance	9	1,448	736	2,025

Source: Oklahoma Survey Data.

TABLE 17

ANNUAL DENTAL AND SUPPORT PERSONNEL COSTS,
RURAL OKLAHOMA, 1986

Position	Number of Observations	Salaries[a]		
		Average	Range	
			Low	High
Dental Personnel				
Hygienist	6	17,400	13,704	23,750
Dental Assistant	9	13,110	9,040	14,400
Support Personnel				
Receptionist	5	10,642	7,500	13,800
Bookkeeper/Office Manager	5	11,628	9,600	15,600

Source: Oklahoma Survey Data.

[a]Fringe benefits: 15% of total salary.

of a dental hygienist was $17,400 and ranged from a low of $13,704 to a high of $23,750. In some categories, the number of observations was low and the resulting averages appear large. For example, there was one bookkeeper/office manager making $15,600 per year. By comparison, this salary was higher than a dental assistant making $14,400 per year. Years of experience, size of practice, and so on, were not accounted for in this analysis. Local wage rates should be used, if available, to determine specific annual personnel costs. Fringe benefits were found to average approximately 15 percent of total salary.

Once estimates of building, office, dental, and personnel operating costs are determined, total annual operating costs are determined by summing these categories together.

Total Annual Costs

The last calculations necessary to estimate total annual costs are to (1) determine the payments per year made on the capital investment, and (2) add them to annual operating costs. Annual capital charges are determined by deriving principal and interest charges on the amount of borrowed capital investment. Calculation of total costs is shown in Chapter V, in the application section.

Estimating Net Income

The calculation of dental net income is obtained by subtracting total costs from gross income. The income should be considered given various collection rates to achieve a more accurate estimate. An example of these calculations is shown in Chapter V.

Data in Table 18 present income data from national research data, a standard by which to view income estimates. It presents average net income per dentist for 1985. The average for Oklahoma general practitioners was $63,831.

These estimates for expenses and income are for dentists who have been in practice at least five years or more. The new dentist does not necessarily need all of the equipment mentioned. For example, by only having one operatory, the dentist would have $49,042.15 in total equipment costs compared to $59,008.15 with three operatories. This reduction of $9,966 is achieved by eliminating only a few major items. Also, if the dentist hires one dental assistant and one receptionist, personnel costs would be $27,616.10 compared to $49,428.15 previously mentioned, a reduction of $21,812.05. Another area in which the new dentist could reduce his/her budget would be operating expenses. Since the dentist does not need as much space with one operatory, building operating expenses should be reduced.

TABLE 18

MEAN NET INCOME OF SOLO DENTISTS, BY U.S. REGION AND SOURCE OF DENTAL INCOME, 1985

Region	All Solo Dentists	Solo General Practioners	Solo Specialists
	----------Mean----------		
New England[a]	$ 57,820	$ 54,920	$ --
Middle Atlantic	62,150	57,760	89,760
East North Central	67,630	59,620	120,120
West North Central[a]	57,010	54,700	--
South Atlantic	71,600	65,020	115,070
East South Central[a]	64,390	59,690	--
West South Central	73,880	68,950	92,050
Mountain	62,790	59,880	79,240
Pacific	72,080	66,500	107,970

Source: American Dental Association, 1986 Survey of Dental Practice.

[a]For specialists in the New England, West North Central, and East South Central regions, results are not reported because the small number of responses from these areas were insufficient to ensure reliable statistical results.

CHAPTER V

APPLICATION

Introduction

As established dentists and dental students evaluate alternative locations, it is important to be able to evaluate the potential of each location. Likewise, if a community committee is seeking to attract a dentist, the committee needs to know whether or not their service area can support a dentist. Forms were developed to allow community leaders to evaluate their community's ability to support a dentist or to allow a prospective dentist to analyze a community's economic potential. More specifically, the forms are intended to be used as worksheets to:

1. estimate the number of dental visits for a service area;
2. estimate the number of dentists the service area can support;
3. estimate equipment costs for a dental practice;
4. estimate annual capital costs (land, building, and equipment);
5. estimate annual operating costs (building, office, dental, and personnel);
6. estimate total annual cost;
7. estimate net income and evaluate the effect of alternative collection rates; and

8. evaluate annual revenue and profit (loss) from renting an office to a dentist.

Indices necessary to adjust items to current prices are given in Appendix E. Blank forms are presented for use in Appendix G. In this section, an application of the forms is presented to demonstrate their use.

Application of Forms

The first step is to complete Form 1. To do this, a community service area must be established, and the population of the area determined by sex and age. In many cases, primary and secondary service areas need to be established. The primary area would include those places where people would be most likely to use the dentist, while the secondary area would include those places where residents may travel to nearby communities for dental services. This can be done using regional economic tools.

Once these service areas have been determined, population estimates must be made. This can be done by using 1980 Census data since it breaks down the population into the appropriate age categories for males and females. Projections can be made for more recent population estimates by using supplemental census data. (In Oklahoma, the Oklahoma Employment Security Commission publishes annual updates). If the service areas determined by community leaders require population counts which do not lie within Census divisions, then alternative resources must be used. Highway maps prepared by the State Department of Transportation are useful because they show the number of households in an area. By counting houses and using the

FORM 1

ESTIMATING THE NUMBER OF ANNUAL DENTAL OFFICE VISITS
BY DEMOGRAPHIC CHARACTERISTICS FOR A SERVICE AREA

Characteristics	Population	Oklahoma Utilization Rates	Total Number of Visits	National Utilization Rates	Total Number of Visits
All Persons	2,926	2.36	6,905	1.7	4,974
Sex: Male	1,328	2.38	3,160	1.6	2,124
Female	1,598	2.35	3,755	1.8	2,876
			6,915		5,000
Age: <17	729	2.25	1,640	1.6	1,166
17-44	892	2.36	2,105	1.7	1,516
45-64	593	2.43	1,440	1.8	1,067
65+	712	2.41	1,716	1.5	1,068
			6,901		4,817
		Average	6,907		4,930

numbers of persons per household as determined by the Census, population estimates can be made for service areas. In practice, a combination of the above methods will yield the most satisfying results.

Once population estimates are determined, Form 1 should be filled out as shown. In this example, a single community is used as the service area. The population numbers are filled in the appropriate blanks and multiplied by their respective utilization rates. Total visits are calculated for each category. Using the data to estimate dental visits is difficult as it is impossible to say which characteristic is most important. By presenting estimates based on all characteristics, the user can select the one which is most meaningful for that service. If none are singled out, then the average can be used. For example, the average total annual number of dental visits per year was 6,907 using Oklahoma utilization rates and 4,930 using national utilization rates.

On Form 2, the number of dentists an area can support is calculated. Comparisons can be made using the results from the survey of rural Oklahoma dentists and the national survey. This is done by first filling in the total number of dental visits per year. Then, divide total visits by the number of dental visits per year per dentist to determine the total number of dentists the area can support. For example, the average number of dentists an area can support using the number of visits projected from Oklahoma utilization rates was 2.34, while the average using the national survey results was 1.75.

FORM 2

AN ESTIMATE OF THE NUMBER OF DENTISTS THE SERVICE AREA CAN SUPPORT

Total Number of Dental Visits Per Year	Results from Rural Oklahoma Dentists Survey: Number of Dental Visits Per Year Per Dentist		Results from Rural Oklahoma Dentists Survey: Total Number of Dentists the Area Can Support	Results from National Survey: Number of Dental Visits Per Year Per Dentist		Results from National Survey: Total Number of Dentists the Area Can Support
Oklahoma						
6907	1,837	Low	3.76	3,271	Low	2.11
6907	2,948	Average	2.34	3,941	Average	1.75
6907	4,059	High	1.70	5,134	High	1.34
National						
4930	1,837	Low	2.68	3,271	Low	1.50
4930	2,948	Average	1.67	3,941	Average	1.25
4930	4,059	High	1.21	5,134	High	.96

Once the number of office visits per year per dentist is determined (from Form 2), that number is substituted into Form 3 to estimate gross income. Average, low, and high rates charged by dentists are used to generate a range of expected revenue. These average rates are from the Oklahoma survey data.

Equipment costs are calculated on Form 4 by specifying types and amount of equipment for the dental office. Unless other specific items for the dental office are desired, the typical equipment for a dental office can be identified using Table 11. In this example, the equipment for a typical solo practice is itemized. On the last page of the form, the costs are summarized. For a typical solo practice in 1986, equipment costs total $59,008.15.

On Form 5, all capital costs are examined. First, building costs are specified and adjusted by the Current Construction Cost Index to reflect current prices. Land and parking lot costs should be locally determined. Equipment costs, calculated on Form 4, are adjusted to reflect current prices based on the Current Construction Cost Index. Annual capital charges are calculated on Form 6 based on the length of the loan and interest rate of the loan. A table of amortization factors is presented in Appendix F. Assuming a 20-year loan at 10 percent interest on a building and a 10-year loan at 13 percent interest on equipment, the annual charge for capital is $20,084.52; $9,318.66 for the building, land, and parking lot, and $10,765.86 for the equipment.

Form 7 is used to calculate annual operating costs. These are calculated on a per dentist basis except for electricity and gas.

FORM 3

ESTIMATING GROSS INCOME

Number of Visits[a]	Rate Schedule			Revenue		
	High[b]	Average	Low[b]	High	Average	Low
2948	x 68.23			= 201,142.04		
		x 61.38			= 180,948.24	
			x 54.53			= 160,754.44

Source: Oklahoma Survey Data.

[a]Average number of dental office visits per year on a 48 week work year.

[b]Defined as within one standard deviation of the mean.

FORM 4

ESTIMATING EQUIPMENT COSTS

Equipment Type	Number of Items		Price Per Unit (1986) Dollars		Total Cost Dollars
Reception Room					
Chairs, single	7	x	105.00	=	735.00
Magazine rack	1	x	64.00	=	64.00
End table	1	x	125.00	=	125.00
Occasional table	1	x	129.00	=	129.00
Other:		x		=	
		x		=	
		x		=	
Total, Reception Room				=	1,067.00
Business Office					
Calculator/adding machine	1	x	99.00	=	99.00
Chairs, secretarial	2	x	136.00	=	272.00
Copy machine	1	x	700.00	=	700.00
Desk	2	x	445.00	=	890.00
File cabinets	3	x	275.00	=	825.00
Telephone	1	x	135.00	=	135.00
Telephone answering machine	1	x	200.00	=	200.00
Typewriter	1	x	1,018.00	=	1018.00
Wastebaskets	2	x	13.00	=	26.00
Business office supplies[a]				=	606.90
Other: Computer		x		=	
		x		=	
		x		=	
Total, Business Office				=	4,771.90
Dentist's Office					
Bookshelf	2	x	148.00	=	296.00
Chair	3	x	282.00	=	846.00
Desk	1	x	364.00	=	364.00
File cabinet	1	x	100.00	=	100.00
Telephone	1	x	165.00	=	
Other:		x		=	
		x		=	
		x		=	
Total, Dentist's Office				=	1,771.00
Operatories					
Assistant stool	3	x	334.00	=	1,002.00
Autoclave/chemiclave	1	x	1,260.00	=	1,260.00

FORM 4 (Continued)

Equipment Type	Number of Items		Price Per Unit (1986) Dollars		Total Cost Dollars
Cabinet (portable)	2	x	812.50	=	1,625.00
Cabinet (modular) group	2	x	2,466.00	=	4,932.00
Cleaner, autoclave/chemiclave	1	x	22.50	=	22.50
Cleanser, high volume evacuation (1 box)	1	x	18.00	=	18.00
Compressor	1	x	1,315.00	=	1315.00
Contra angle (engine drive) (standard or pedo)	6	x	70.00	=	420.00
Contra angle (air)	2	x	490.00	=	980.00
Dental chair	3	x	2,650.00	=	7950.00
Dento-dri	1	x	352.50	=	352.50
Dento-drain	1	x	45.00	=	45.00
Electric amalgamator	2	x	275.00	=	550.00
Electrosurg	1	x	360.00	=	360.00
Emergency oxygen unit	1	x	141.00	=	141.00
Oxygen cylinder & contents for above	1	x	70.00	=	70.00
Handpiece (engine driven)	2	x	302.00	=	604.00
Handpiece, straight (air driven)	4	x	445.00	=	1,780.00
Hydrocolloid conditioner (includes syringes)	1	x	42.95	=	42.95
Instrument sharpener	1	x	162.50	=	162.50
Music system	1	x	550.00	=	550.00
Nitrous oxide sedation unit, central gas system required	1	x	960.00	=	960.00
Operating light bulb (spare)	3	x	25.00	=	75.00
Operating light (unit mounted)	3	x	679.00	=	2,037.00
or					
Operating light (ceiling mounted, single)	3	x	783.00	=	2,349.00
Operating instruments & accessories[a]				=	1,025.17
Surgical supplies & accessories[a]				=	1,312.25
Operating room supplies[a]				=	829.75
Other: _____		x		=	
_____		x		=	
_____		x		=	
Total, Operatories				=	30,351.62

FORM 4 (Continued)

Equipment Type	Number of Items		Price Per Unit (1986) Dollars		Total Cost Dollars
Laboratory					
Articulators	4	x	82.50	=	330.00
Articulators, adjustable	1	x	267.00	=	267.00
Benches	1	x	700.00	=	700.00
Burnout oven	1	x	450.00	=	450.00
Casting machine	1	x	287.50	=	287.00
Clasp surveyor	1	x	193.75	=	193.75
Dust collector	1	x	187.50	=	187.50
Electric welder (for orthodontic procedures)	1	x	600.00	=	600.00
Fire extinguisher	1	x	33.00	=	33.00
Gas/air torch	1	x	70.00	=	70.00
Gram weight scale	1	x	52.50	=	52.50
Glass measuring graduates, cc.	1	x	5.83	=	5.83
Handpiece, laboratory (belt driven)	1	x	255.00	=	255.00
Laboratory chair (not stool)	1	x	67.50	=	67.50
Laboratory engine (incl. w/ handpiece)	1	x	443.75	=	443.75
Laboratory light (bench)	1	x	67.00	=	67.00
Laboratory stool	1	x	87.50	=	87.50
Laboratory workbench, fireproof, consisting of stainless steel sink; plaster trap; air, gas model trimmer valves	1	x	1,500.00	=	1,500.00
Lathe	1	x	182.00	=	182.00
Model trimmer	1	x	307.00	=	307.00
Plaster bin	1	x	150.00	=	150.00
Polishing hood w/ removable pan	1	x	167.50	=	167.50
Safety glasses	1	x	62.50	=	62.50
Staining, glazing furnace (opt.)	1	x	600.00	=	600.00
Vacuum investing machine (opt.)	1	x	350.00	=	350.00
Vibrator	1	x	104.00	=	104.00
Work pans, metal or plastic	20	x	11.00	=	220.00
Laboratory supplies & accessories[a]				=	1,748.05
Filling materials & supplies[a]				=	1,855.55
Prosthetic supplies & accessories[a]				=	1,468.70
Other: Paper & cotton goods		x		=	174.75
		x		=	
		x		=	
Total, Laboratory				=	12,987.88

FORM 4 (Continued)

Equipment Type	Number of Items	Price Per Unit (1986) Dollars	Total Cost Dollars
Darkroom			
Intermediate KV (70 KV)	2	x 2,640.00	= 5,280.00
or			
High KV (90 KV)	2	x 4,433.00	= 8,866.00
Darkroom timer	1	x 10.00	= 10.00
Developing tank (temperature regulator)	1	x 275.00	= 275.00
Film clips (1 box 12)	1	x 24.00	= 24.00
Film dispenser (1 per operatory)	2	x 48.00	= 96.00
Film duplicator	1	x 158.00	= 158.00
Film hangers	10	x 15.00	= 150.00
Film projector magnifier[b]	—	x —	= —
Film receptacle	1	x 30.00	= 30.00
Intensifying screen & cassette	1	x 110.00	= 110.00
Laboratory apron	1	x 21.00	= 21.00
Magni-focuser[b]	—	x —	= —
Safe light	1	x 55.00	= 55.00
X-ray processor			
Intra-oral	1	x 2,035.00	= 2,035.00
or			
Extra-oral	1	x 2,387.50	= 2,387.50
X-ray supplies & accessories			= 174.75
Other: _____	_____	x _____	= _____
_____	_____	x _____	= _____
_____	_____	x _____	= _____
Total, X-Ray/Darkroom			= 8,058.75

Equipment Summary	Total Cost
Reception Room	$1067.00
Business Office	4,771.90
Dentist's Office	1,771.00
Operatories	30,351.22
Laboratory	12,987.88
Darkroom	8,058.75
TOTAL COSTS	$59,008.15

Source: Survey Data.

[a]See Appendix C for a detailed listing.
[b]Data not available.

FORM 5

ESTIMATING CAPITAL COSTS

Note: All capital costs must be adjusted to reflect current prices. To do this, calculate adjustments as follows:

$$\text{Capital Items Price Adjustor}^{a} = \frac{(111.10)\ \text{Current Construction Cost Index})}{(112.0)\ \text{1986 Construction Cost Index})}$$

I. Building

A. Number of dentists 1
B. Square feet per dentist 1,255 sq. ft.
C. Square feet in building
(Item A x Item B) 1,255 sq. ft.
D. Construction cost per square foot
(Average $55.00/sq. ft.) $ 55.00
E. Construction cost of building
(Item C x Item D) $69,025.00
F. Construction cost adjusted to current price levels
(Item E x .99 capital items price adjustor) $68,334.75

II. Land and Parking Lot
(Locally determined price) $11,000.00

III. Equipment

A. Total equipment costs (Form 4) $59,008.15
B. Equipment costs adjusted to current price levels
(Item A x .99 capital items price adjustor) $58,418.06

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[a]See Appendix E.

FORM 6

ESTIMATING ANNUAL CAPITAL CHARGES

I. Annual Charge for Building, Land, and Parking

A.	Cost of building, land, and parking (From Form 5, Items I.F and II)	$79,334.75	
B.	Length of loan	20 years	
C.	Interest rate on loan	10 percent	
D.	Amortization factor (From Appendix G, given length of loan and interest rate)	.11746	
E.	Annual capital charge (Item A x Item D)		$9,318.66

II. Annual Capital Charge for Equipment

A.	Cost of equipment (From Form 5, Item III.B)	$58,418.06	
B.	Length of loan	10 years	
C.	Interest rate on loan	13 percent	
D.	Amortization factor (From Appendix G, given length of loan and interest rate)	.18429	
E.	Annual capital charge (Item A x Item D)		$10,765.86

III. Total Annual Capital Charges (Item I.E + Item II.E) $20,084.52

FORM 7

ESTIMATING ANNUAL OPERATING COSTS

Note: All costs must be adjusted to reflect current prices. To do this, calculate adjustment as follows:

$$\text{Adjustor}^{a} = \frac{(335.9)\ \text{Current Consumer Price Index}}{(328.4)\ 1986\ \text{Consumer Price Index}} = 1.02$$

I. BUILDING

A. Rent (if not purchased)
$712.00 (1986 rent) x 1.02 (price adjustor) = $726.24
(Average in Table --)

B. Electricity and Gas
2.39 /square foot (1986) x 1,255 square feet x 1.02 (price adjustor) = $3059.43

C. Water, Sewer, Trash
643.00 /dentist (1986) x 1.02 (price adjustor) = $655.86

D. Maintenance
1,140.00 /dentist (1986) x 1.02 (price adjustor) = $1162.80

E. Janitor
1,763.00 /dentist (1986) x 1.02 (price adjustor) = $1,798.26

F. Taxes
924.00 /dentist (1986) x 1.02 (price adjustor) = $942.48

G. Insurance (complete one line only)

1. Equipment only
   $57.29 /dentist (1986) x — (price adjustor) = $ —
2. Building and equipment
   $530.11 /dentist (1986) x 1.02 (price adjustor) = $ 540.71

H. Other
   $ 0 /dentist (1986) x — (price adjustor) = $ 8,229.92

I. Total Annual Building Expenses Per Dentist
   (A + B + C + D + E + F + G + H) = $ 8,229.92

J. Total Annual Building Expenses
   (Item I x 1 number of dentists) = $ 8,229.92

II. OFFICE

A. Telephone
   $1,782.00 /dentist (1986) x 1.02 (price adjustor) = $ 1,817.64

B. Office Supplies, Office Equipment and Billing
   $4138.00 /dentist (1986) x 1.02 (price adjustor) = $ 4220.00

C. Fees for Professional Services
   $3205.00 /dentist (1986) x 1.02 (price adjustor) = $ 3,269.10

D. Auto Expenses
   $1383.00 /dentist (1986) x 1.02 (price adjustor) = $ 1,410.66

E. Conventions
   $2356.00 /dentist (1986) x 1.02 (price adjustor) = $ 2403.12

F. Professional Dues and Licenses
$1137.00 /dentist (1986) x 1.02 (price adjustor) = $1159.74

G. Other
$ — /dentist (1986) x — (price adjustor) = $ 0

H. Total Annual Office Expenses Per Dentist
(A + B + C + D + E + F + G) = $14,281.02

I. Total Annual Office Expenses
(Item H x 1 number of dentists) = $14,281.02

III. Dental

A. Dental Equipment Maintenance
$703.00 /dentist (1986) x 1.02 (price adjustor) = $717.06

B. Dental Supplies (includes equipment and lab fees)
$13,580.00/dentist (1986) x 1.02 (price adjustor) = $13,851.60

C. Malpractice Insurance
$1,448.00 /dentist (1986) x 1.02 (price adjustor) = $1,476.96

D. Other
$ 0 /dentist (1986) x — (price adjustor) = $ 0

E. Total Annual Dental Expenses Per Dentist
(A + B + C + D) = $16,045.62

F. Total Annual Dental Expenses
(Item E x 1 number of dentists) = $16,045.62

FORM 7 (Continued)

IV. PERSONNEL

Type	1986 Salary	x	Price Adjustor	=	Current Salary	x	Number Employed	=	Total Cost
A. Hygienist	$17,400	x	1.02	=	$17,748	x	1	=	$17,748
B. Dental Assistant	$13,110	x	1.02	=	$13,372.	x	1	=	$13,372
C. Receptionist	$10,642	x		=	$	x		=	$
D. Bookkeeper	$	x		=	$	x		=	$
E. Recept./Bookkeeper	$	x		=	$	x		=	$
F. Office Manager	$	x		=	$	x		=	$
G. Bookkeeper/Ofc. Mgr.	$11,628	x	1.02	=	$11,861	x	1	=	$11,861
H. Other	$	x		=	$	x		=	$

I. Total Personnel Costs Without Fringe Benefits
(A + B + C + D + E + F + G + H) = $42,981

J. Fringe Benefits
(.15 x Item I) = $6,447.15

K. Total Annual Personnel Costs Per Dentist
(L + M) = $49,428.15

L. Total Annual Personnel Costs
(Item K x _____ number of dentists) = $49,428.15

[a]See Appendix E.

Electricity and gas are calculated based on the square footage of the dental office. All expenses are adjusted to reflect current prices by using the Consumer Price Index. Annual operating expenses were: building $8,229.92; office, $14,281.02; dental $16,045.62; and personnel, $49,428.15.

Total annual costs and the resulting net income are determined on Forms 8 and 9. In this example, annual capital and operating costs total $108,069.23. By using gross income from Form 3, net income can be calculated at the average, low, and high rate schedules. In item 7 of Form 9, net income is calculated given various collection rates, ranging from 80-95 percent of billings. The forms to calculate income and costs may be used repeatedly to depict various scenarios, i.e. different size offices, rental agreements, or number of visits. Net income per dentist with a 100-percent collection rate ranged from $52,685.21 to $93,072.01, depending on the fee structure. With a collection rate of 90%, net income per dentist ranged from $36,609.77 to $72,958.60.

Form 10 allows for the calculation of annual revenue and profit (loss) to a community renting facilities to a dentist. Decisions must be made regarding capital and operating costs covered under the rental agreement, and rental charges. Respective profits or losses can then be calculated as shown. For example, if the community planning committee were to build a facility with 1,255 square feet per dentist on city land, not equip it, and pay the operating costs for at least one year, yearly annual costs would be $17,548.58. If they charged a monthly rent of $1,600.00, they would net $1,651.42 per year.

FORM 8

ESTIMATING TOTAL ANNUAL COSTS

I.	Total Annual Capital Charges (From Form 6, Item III)		$20,084.52
II.	Total Annual Operating Costs		
	A. Building (Form 7, Item I.J)	$8229.92	
	B. Office (Form 7, Item II.I)	$14,281.02	
	C. Dental (Form 7, Item III.F)	$16,045.62	
	D. Personnel (Form 7, Item IV.L)	$49,428.15	
	E. Total Operating Costs (II.A + II.B + II.C + II.D)		$87,984.71
III.	Total Annual Capital and Operating Costs (Items I + II.E)		$108,069.23

FORM 9

ESTIMATING NET INCOME

		Rate Schedule--Dollars		
		Low	Average	High
I.	Gross Income (100% Collection) (From Form 3)	160,754.44	180,948.24	201,142.04
II.	Total Costs (From Form 8, Item III)	108,069.23	108,069.23	108,069.23
III.	Net Income (Item I - Item II)	52,685.21	72,879.01	93,072.81
IV.	Number of Dentists	1	1	1
V.	Net Income Per Dentist (Item III - Item IV)	52,685.21	72,879.01	93,072.01
VI.	Gross Income Given Alternative Collection Rates (Item 1 x Percentage Given			
	Collection Rate			
	A. 95%	152,716.71	171,900.82	191,084.93
	B. 90%	144,679.00	162,853.41	181,027.83
	C. 85%	136,641.27	153,806.00	170,970.73
	D. 80%	128,603.55	144,758.59	160,913.63

FORM 9 (Continued)

	Rate Schedule--Dollars		
	Low	Average	High
VII. Net Income Per Dentist Given Alternative Collection Rates (Items VII.A-D ÷ Item IV)			
Collection Rate			
A. 95%	44,646.87	63,831.59	83,015.70
B. 90%	36,609.77	54,784.18	72,958.60
C. 85%	28,572.04	45,736.77	62,901.50
D. 80%	20,534.32	36,689.36	52,844.40
VIII. Net Income Per Dentist Given Alternative Collection Rates (Item VII.A-D ÷ Item IV)			
Collection Rate			
A. 95%	44,646.87	63,831.59	83,015.70
B. 90%	36,609.77	54,784.18	72,958.60
C. 85%	28,572.04	45,736.77	62,901.50
D. 80%	20,534.32	36,689.36	52,844.40

FORM 10

ANNUAL REVENUE AND PROFIT (LOSS) FOR A COMMUNITY FROM RENTING A BUILDING TO A DENTIST

I. Annual Cost

A. Capital Costs
(1) Building, Land Parking (Form 6, Item I.E) $9318.66
(2) Equipment (Form 6, Item II.E) $0

B. Operating Costs
(1) Building (Form 7, Item I.J) $8229.92
(2) Other $0

C. Total Annual Costs (A+B) $17,548.58

II. Annual Revenue and Profit or Subsidy

Sample Monthly Rental Charge Per Dentist		Number of Dentists		Months		Annual Revenue		Annual Total Costs (Item I.C)		Profit or Subsidy
800	x	1	x	12	=	9,600	-	17,548.58	=	-7948.58
1,000	x	1	x	12	=	12,000	-	17,548.58	=	-5548.58
1,200	x	1	x	12	=	14,400	-	17,548.58	=	-3148.58
1,400	x	1	x	12	=	16,800	-	17,548.58	=	-748.58
1,600	x	1	x	12	=	19,200	-	17,548.58	=	1651.42
1,800	x	1	x	12	=	21,600	-	17,548.58	=	4051.42

CHAPTER VI

SUMMARY, APPLICATION, LIMITATIONS AND FURTHER RESEARCH

Summary

Many rural areas in Oklahoma are without an adequate number of dentists to provide dental care. The primary objective of this study was to develop methods to aid (1) prospective dentists as they make locational decisions and (2) community leaders as they make decisions regarding the provision of dental care for their residents. The objective was accomplished by developing methods which could be used to:

1. determine the number of dentists an area can support;
2. estimate annual capital and operating costs for a rural dental office; and
3. project gross income and net income for a dentist.

Determining the Number of Dentists an Area Can Support

The number of dentists needed in a rural area is a direct function of the number of dental visits the area will generate. Two approaches were taken to predict the number of dental visits specifically for Oklahoma. The first used regression analysis; the second, population ratios. The coefficients determined from the

regression analysis reflected the change in dental visits per unit change in the independent variables, i.e., age, amount of insurance, amount of out-of-pocket expenses, and income. From the population ratios, national utilization data indicating the number of dental visits by age and sex were used as a comparison with the utilization rates determined for Oklahoma. For example, a patient who is 25 years old, their insurance pays $125, and their out-of-pocket expenses are $50, will have 2.1 dental visits per year using the regression coefficients. Using the utilization rates generated for Oklahoma, the same person would have 2.36 visits per year compared to 1.7 visits per year determined using the national utilization rates.

Once a service area is determined and the population is specified by age and sex, the number of dental visits for a typical dentist will yield the number of dentists an area can support.

Estimating Annual Capital and Operating Costs

To provide data for capital and operating costs, 13 dentists in Oklahoma were interviewed. Survey results provided an inventory of equipment as well as information concerning operating items and costs. Dental equipment dealers and construction firms were interviewed to obtain costs of capital items.

From the survey results, procedures were devised to estimate:

1. capital requirements (land, building, equipment);
2. annual capital charges;
3. personnel requirements; and
4. operating costs (building, office, personnel, dental).

For instance, the capital requirements in the example were $59,008.15 and annual capital charges totalled $20,274.35. Personnel requirements were for three employees: a hygienist, a dental assistant, and a bookkeeper/office manager. Operating costs were determined to be $84,202.26.

Projecting Total Revenue and Net Income

Rate schedules for dental services were obtained from the survey of the 13 rural Oklahoma dentists. If a dentist is evaluating a potential practice, the dentist can select a rate schedule and apply it to his services to derive an estimate of total annual revenue. Likewise, the dentist can use the cost data to estimate total annual costs. The subtraction of costs from revenue will yield an estimate of net income.

If the community leaders are considering constructing facilities and renting to a prospective dentist, they can use capital and operating costs derived above to determine a monthly rental rate which will allow them to break even or determine how much of a subsidy they are willing to provide.

Application

Several easy-to-use forms were devised for use by prospective dentists and community leaders. These forms allow the decision maker to conduct the study with a minumum of professional assistance. Forms are devised to:

1. estimate the number of annual dental office visits by age cohort and determine the total number of dental visits for a given service area;

2. estimate the number of dentists an area can support;

3. estimate an average and range of gross income;

4. estimate equipment costs for a solo practice;

5. estimate annual capital costs (land, building, and equipment);

6. estimate annual operating costs (building, office, dental, and personnel);

7. estimate total annual costs;

8. estimate net income and evaluate the effect of alternative collection rates; and

9. evaluate annual revenue and profit (loss) from renting a facility to a dentist.

To illustrate their usefulness, the forms and research results were used to analyze the feasibility of a dentist in an example community.

Rural areas face greater difficulty than do urban areas in attracting and retaining dentists, since many dentists tend to locate in metropolitan areas. The procedure developed in this study should allow community leaders the tools to evaluate their community as to whether or not it can support a dentist(s). Also, these procedures provide dentists a tool to allow them to evaluate alternative locations.

Limitations and Additional Research

Although utilization rates were determined for Oklahoma, further research should be done to test the reliability and accuracy of these data. While the use of national data provides a reasonable estimate of dental need, use of local data is preferred. Developing state

dental utilization rates by rural and urban areas would be very useful. For example, Oklahoma is divided into eight dental districts. These areas could be studied regarding utilization of dental services and have specific utilization rates for them. Urban areas such as Tulsa and Oklahoma City could have utilization rates specifically for them.

Another area of useful research would be to adapt the procedures developed in this study into a computer program. Speed and reduced error in computation would be the primary benefits of this research. For example, a dentist may want to explore the cost difference of establishing a practice in buildings of various sizes.

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APPENDICES

APPENDIX A

DETAILED RATE SCHEDULE FOR DENTAL SERVICES

TABLE A

RATE SCHEDULE FOR PHYSICIAN SERVICES,
RURAL OKLAHOMA DENTISTS
1986

Item	Number of Observations	Average Price	Standard Deviation[a]	Range	
				Low	High
		----------Dollars----------			
Clinical Oral Examination					
Initial oral exam	13	18.20	9.70	10.00	50.00
Periodic oral exam	11	12.60	2.60	8.00	16.00
Emergency oral exam	10	18.00	5.80	5.00	28.00
X-Rays					
Individual	10	6.30	2.80	3.00	12.00
4 BWX	2	20.00	--	20.00	20.00
Full-mouth	7	40.00	9.00	30.00	60.00
Dental Prophylaxis					
Adults	13	27.90	2.00	25.00	32.00
Children	12	21.00	4.30	15.00	30.00
Flouride Treatment	12	11.50	5.10	5.00	20.00
Extraction (simple)	13	31.10	10.20	15.00	50.00
Silver Restoration					
1-surface amalgam	11	28.90	3.50	24.00	35.00
2-surface amalgam	5	40.00	3.80	36.00	46.00
3-surface amalgam	11	57.00	15.20	40.00	96.00

TABLE A (Continued)

Item	Number of Observations	Average Price	Standard Deviation[a]	Range	
				Low	High
		----------Dollars----------			
1-Surface Composite Restoration	8	36.50	12.90	28.00	69.00
2-Surface Composite Restoration	7	43.30	4.60	38.00	50.00
Full Gold Crown	10	335.60	62.70	200.00	450.00
Porcelain With Metal Crown	7	332.60	49.30	250.00	425.00
Crown or Bridge Service	13	342.10	43.70	300.00	460.00
Complete Upper and Lower Dentures	10	795.50	88.70	600.00	884.20
Gingival Treatment (per quadrant)	9	49.90	18.20	20.00	75.00
Root Canal					
1 canal	9	175.20	20.70	150.00	225.00
2 canals	8	209.60	17.20	190.00	250.00
3 canals	8	250.90	23.00	215.00	300.00

Source: Oklahoma Survey Data.

[a]Sixty percent of the observations are within one standard deviation of the average, except for the silver restoration, i.e. 2-surface amalgam.

APPENDIX B

GEOGRAPHIC REGIONS OF THE UNITED STATES

TABLE B

GEOGRAPHIC REGIONS OF THE UNITED STATES

New England: CT, ME, NH, RI, VT, MA

Middle Atlantic: NJ, NY, PA

East North Central: IL, IN, MI, OH, WI

West North Central: IA, KS, MN, MO, ND, NE, SD

South Atlantic: DE, MD, DC, FL, GA, NC, SC, VA, WV

East South Central: AL, KY, MS, TN

West South Central: AR, LA, OK, TX

Mountain: AZ, CO, ID, MT, NV, NM, UT, WY

Pacific: AK, CA, HI, OR, WA

APPENDIX C

DETAILED COSTS OF SUPPLEMENTAL EQUIPMENT

Item	General Price Range		Recommended Minimum Quantity
Business Office Supplies			
Appointments			
Appointment book	$ 9.95-	45.00	
Appointment cards/slips	9.00-	14.00	1,000
Desk calendars	5.00-	15.00	
Recall letters or cards	10.00-	15.00	
Bookkeeping System	35.00-	650.00	
Single volume log OR			
Pegboard system			
Billing System			
Ledger cards	7.00-	25.00	500
Statements	15.00-	45.00	500
Envelopes	12.00-	25.00	500
Collection aids	6.00-	18.00	
Time payment booklets	4.95-	18.40	
Patient Record Forms			
Patient charts	14.75-	34.20	200
Registration forms	6.00-	8.00	500
Medical/dental histories	6.25-	22.00	200
Referral slips	3.00-	6.00	500
Stationery			
Announcement cards	11.50-	18.00	250
Letterheads	24.00-	78.00	500
Envelopes	15.00-	40.00	500
Prescription blanks	13.00-	24.00	1,000
Professional cards	16.00-	40.00	1,000
Filing Systems			
File envelopes or folders	55.00-	75.00	1,000
Indexing	8.00-	12.00	
Insurance forms	4.00-	12.00	
General			
Drug envelopes	5.00-	9.00	500
Magazine binders	9.00-	16.00	3-5
Office signs	7.50-	28.00	2
Demonstrating models	-		
Patient education literature	-		

Item	General Price Range	Recommended Minimum Quantity
Equipment, Office		
Adding machine	45.00- 125.00	
Typewriter	250.00- 1,400.00	
File cabinets	-	
Chairs, desk	-	
Chairs, straight		
Computer System		
CRT (screen) & keyboard	400.00- 2,200.00	1
Central processing unit (20 megabytes)	3,500.00-20,000.00	1
Printer (letter quality)	1,200.00- 1,800.00	1
Software	1,000.00-12,000.00	
Modern (optional)	250.00- 1,000.00	
Equipment, Reception Room		
Chairs, occasional and/or straight	-	
Decorative items	-	
Lamps/lighting	-	
Magazine rack	-	
Tables, end/occasional	-	
Mirrors	-	
Material for children	-	
Totals	$ 6,956.90-39,817.60	
Laboratory Equipment		
Air blowgun with quick disconnect	$ 30.00- 40.00	1
Articulators	25.00- 95.00	1
Articulators, adjustable	130.00- 270.00	1
Asbestos gloves	16.00	1
Benches	250.00- 450.00	1
Burnout oven	165.00- 700.00	1
Casting machine	170.00- 215.00	1
Casting and soldering bench, fire proof (optional)	500.00- 1,100.00	1
Clasp surveyor	110.00- 160.00	1
Dust collector	95.00- 830.00	1
Electric welder (for orthodontic procedures)	235.00- 295.00	1
Fire extinguisher	45.00	1
Gas/air torch	52.00	1
Gram weight scale	145.00	1
Glass measuring graduates, cc (2 needed)	7.00- 8.50	2

Item	General Price Range	Recommended Minimum Quantity
Handpiece, laboratory (belt driven)	65.00- 310.00	1
Handpiece, laboratory (air driven)	295.00- 525.00	1
Hygrobath (optional)	115.00	1
Laboratory chair (not stool)	85.00- 150.00	1
Laboratory engine (included with hand piece)	275.00- 350.00	1
Laboratory light (bench)	90.00- 110.00	1
Laboratory stool	60.00- 115.00	1
Laboratory work bench,	1,400.00- 2,200.00	1
fire proof, consisting of:		
stainless steel sink,		1
plaster trap,		1
air, gas, model trimmer valves		1
Lathe	100.00- 185.00	1
Model trimmer	200.00- 350.00	1
Plaster bin	62.00	1
Pneumatic pressure curing unit	45.00- 60.00	1
Polishing hood with removable pan	110.00- 225.00	1
Safety glasses	12.00- 25.00	1
Staining, glazing furnace (optional)	275.00- 450.00	1
Ultrasonic cleaner	45.00- 250.00	1
Vacuum investing machine (optional)	200.00- 700.00	1
Vibrator	35.00- 100.00	1
Work pans, metal (24 needed)	4.75- 11.40	24
Totals	$ 5,448.75-10,714.90	
Operating Room Equipment		
Assistant stool	$ 250.00- 600.00	
Autoclave	600.00- 1,500.00	
Cabinet (portable)	250.00- 1,000.00	
Cabinets (modular) group	1,000.00- 7,000.00	
Cleaner, autoclave	18.00- 27.00	
Cleanser--high volume evacuation (1 box)	21.00	
Compressor	925.00- 2,975.00	
Contra angle (engine driven) (standard or pedo)	15.00- 50.00	
Contra angle (air driven)	70.00- 350.00	
Dental chair	2,000.00- 5,000.00	
Dento-dri	255.00- 450.00	
Dento-drain	45.00	
Electric amalgamator	150.00- 600.00	
Emergency oxygen unit	110.00- 320.00	

Item	General Price Range	Recommended Minimum Quantity
Oxygen cylinder & contents for above	25.00- 30.00	
Handpiece, contra angle, high speed	185.00- 419.00	
Handpiece, straight, air driven	275.00- 545.00	
Hydrocolloid conditioner (incl. syringes)	450.00- 500.00	
Incubator	50.00- 145.00	
Instrument sharpener	75.00- 150.00	
Nitrous oxide sedation unit[a]	525.00- 2,200.00	
Operating light bulb (spare)	15.00- 45.00	
Operating light (unit mounted)	450.00- 1,200.00	
Operating light (ceiling mounted) (single)	800.00- 1,500.00	
Operating stool	292.00- 585.00	
Oral evacuator	300.00- 600.00	
Oral evacuator central system	935.00- 2,000.00	
Pneumatic condenser	150.00- 200.00	
Portable pulp tester	85.00- 195.00	
Prophylaxis unit, ultrasonic	895.00- 1,000.00	
Shade selection, color correction light	150.00	
Spare turbine	30.00- 125.00	
Sphygmomanometer	46.00- 165.00	
Sterilizer, dry heat	250.00- 450.00	
Stethoscope	35.00- 65.00	
Sterilizer, glass bead	75.00- 100.00	
Unit, including air driven handpieces	2,500.00- 7,500.00	
View box	40.00- 95.00	
Waste receptacle	25.00- 80.00	
Totals	$15,117.00-39.982.00	

Operating Instruments and Accessories

Abrasive paste	$ 5.50	1 tube
Amalgam carriers	14.50- 35.00	2
Amalgam carvers	15.00	2
Amalgam condensers	20.00	3
Amalgam files	7.95 ea.	1
Articulating paper	12.95	1 box (12 books)
Articulating paper forcep	7.25- 10.30	1
Aspirator & tips	35.50	1

Item	General Price Range		Recommended Minimum Quantity
Bone file	21.00-	34.00	1
Bone chisel	14.60-	16.50	1
Burnishers	18.00-	27.00	3
Copper bands	12.00-	24.95	1 box (100) asst.
Cotton pliers	2.50-	4.75	1 pr.
Cotton roll holders	16.00-	25.70 set	3
Curettes (surgical)	50.00-	76.50	6
Cutting instruments (D.E. or S.E.)	70.00-	115.00	14
Elevators	15.00-	18.25	1
Excavators	34.00		4
Explorers	12.00-	16.50	3
Foil carrier	4.75		1
Gold pluggers	13.50-	16.50	3
Hemostats	18.75		1
Knives	20.00		2
Knives periodontal	48.00-	88.00	4
Mallet	10.00-	45.00	1
Mirror handles (cone-socket)	15.00-	24.00	6
Mouth mirrors	10.50-	19.80	6
Mouth props	15.00-	19.00	2
Napkin chains	3.25-	5.00	2
Needle holders	35.00-	91.00	1
Periosteal	11.50-	17.50	1
Plastic instruments	22.50		3
Pliers	25.00		2
Polishing cups	6.50		2 doz.
Probes (periodontal)	6.40-	9.75	1
Prophylaxis angle	10.00-	25.00	1
Retractors	14.75		8
Rongeur	47.00-	71.00	1
Rubber dam	5.45-	7.95	1 box
Rubber dam clamps	25.50		6
Rubber dam forceps	39.80		1
Rubber dam holders	6.75-	8.25	1
Rubber dam punch	54.00-	79.00	1
Saliva ejectors	5.00-	11.60	2
Scalers & curettes	48.00-	87.50	6
Scissors	27.00-	79.00	1
Separators	10.00-	23.00	1
Sharpening stone	6.50-	32.00	1
Silver abscess probe	10.00		1
Sterilizing forcep	15.00-	28.00	1
Suture needles	15.27		1 doz.
Syringe, rubber base-imp.	10.00-	15.00	1
Wax spatula & carvers	5.45-	8.00	2
Wedges	3.30		1 box (100)

Item	General Price Range	Recommended Minimum Quantity
Mixing bowls & spatulas, plastic	13.00	2 each
Mixing pads	4.00	2
Totals	$ 1,025.17- 1,569.32	
Surgical Supplies and Accessories		
Anti-bacterial skin cleanser	$ 5.95- 7.50	1 qt.
Aspirator	45.00- 125.00	1
Bone chisel	8.95- 15.25	1
Bone file D.E.	11.50- 22.50	1
Cold disinfecting solution	18.00- 35.00 qt.	4 qts.
Container for disinfecting solution	24.00- 40.50	1
Curettes, surgery D.E.	9.75- 22.00	2
Dental face mask	1.50- 7.70	6
Elevators	55.00- 75.00	4
First aid kit	115.00- 250.00	1
Forceps	360.00- 450.00	9
Gauze sponges, sterile	27.50- 38.00	1 box (1,000)
Gauze sponges, non-sterile	98.00- 140.00	1 case (5,000)
Gauze strips	4.25	1
Gauze throat packs	72.00	1 case (1,000)
Germicidal soap	8.50- 22.00	1 qt.
Hemostats	22.50- 45.00	2
Irrigating syringe	5.57	1
Kidney basin	7.50	1
Lancet	6.50	1
Mouth prop (metal: adult/pedo)	110.00	1 pr. ea.
Needle holder	22.50- 55.00	1
Patient's protective apron--plastic	4.00- 7.50	1
Retractor--periosteal	15.50- 21.00	1
Rongeurs	41.50- 72.00	1
Root picks	11.50- 13.50	2
Sterilizing forceps	28.00	1
Scalpel handle	15.00	3
Scalpel surgical blades, sterile	12.00- 30.00	3 doz.
Surgical burs, angle & straight	18.00	6
Surgical dressing	3.00	1 tube
Surgical handle	4.60- 5.80	1
Surgical mallet	10.00- 34.00	1
Surgical medicaments	25.00- 35.00	Varies
Surgical scissors	36.00	2
Surgical suction tips	14.00- 16.00	4
Sutures, sterile w/needles	14.75- 19.00	1 doz.
Suture needles, non-sterile	11.00- 15.50	1 doz.
Tongue blades	8.75	1 box (500)
Totals	$ 1,312.25- 1,934.50	

Item	General Price Range		Recommended Minimum Quantity
Laboratory Supplies and Accessories			
Abrasive wheels & disks ($\frac{1}{4}$"-$2.05 ea., $\frac{1}{2}$"-$2.45 ea.)	$ 8.00-	30.00	1 doz.
Acrylic, crown & bridge, basic pkg.	250.00		1
Acrylic flask	15.00		1
Arbor bands	4.50		1 box (100)
Artificial stone	9.00-	16.40	1 25 lb. ctn.
Artificial die stone, crown & bridge	6.00-	17.20	1
Asbestos	21.00		1 med. roll
Base plates	8.50		2 boxes
Bench block	6.00		1
Binocular loops	22.00		1
Boley gauge	13.60		1
Blow pipe	35.00-	60.00	1
Brush wheels	2.00-	4.00	2
Buff wheels, muslin & chamois	2.25		Asst.
Bunsen burner	24.95-	44.50	1
Crown & bridge investment	7.95-	13.00	1 can
Casting rings	12.60-	18.00	3
Carbide burs, assorted	40.50		3 doz.
Crucible former	4.80-	6.75	1
Debubblizer	6.25		1
Denture polish	8.95-	14.50	1
Die material kit	23.95		1
Dowel pins	6.75		1 btl. (100)
Engine belt	4.60		2
Felt wheels & cones	2.00		Asst.
Files	4.95-	8.50	1
Flask	49.50		1
Fluxes	3.75		1
Glass or ceramic mixing jar and cover	7.25		1
Inlay investment	7.60		1 3$\frac{1}{2}$ lb. can
Investment proportioner	6.50		1
Laboratory apron	15.00		1
Laboratory pliers--chrome	22.00-	36.00	2
Laboratory pliers--stainless	22.00-	49.50	2
Laboratory tongs	3.00		1
Lathe	152.00		1
Lathe chuck for arbor bands	3.75		1
Lathe chuck for brush wheel	4.50		1
Lathe chuck for burs	7.00		1
Lathe chuck for carbo wheels	2.60		1
Lathe splasher	18.50-	30.95	1
Model trimming stones or burs	4.25		Asst.

Item	General Price Range	Recommended Minimum Quantity
Picking solution	6.00	1 pt.
Plaster bowls, rubber	6.75	1 med., 1 lg.
Plaster, model, impression, soluble	3.10- 5.00	1 can, small
Plaster knife	2.35- 3.95	1
Plate brushes	4.25	1
Plate shears	8.75- 16.60	1
Porcelain, picking pan	15.90- 21.00	1
Porcelain polishing kit	10.95	1
Preformed wax shapes	19.50	Asst.
Pumice	4.10	1 (1 lb. can)
Rouge	2.25	1
Saw blades	3.50- 10.50	1
Separating medium	3.75- 4.50	1 bottle
Soldering block	5.30	1
Soldering investment	6.25	1
Sprue pins	1.60	1 pkg.(5)
Spatulas, wax & plaster	5.00- 8.00	1
Steel brush wheel	6.00	1
Tin foil & cellophane	9.25	Asst.
Tin foil substitute	4.75	1 bottle, pt.
Torch	37.50	1
Towel receptacle	8.00	1
Tripod	4.10	1
Tripoli	.60- .95	1
Tweezers	4.50	1
Vacuum forming machine	615.00	1
Varnishers	2.00	Asst.
Vaseline	.50	1
Vise	4.95	1
Vulcanite burs	22.30- 26.10 doz.	1 doz.
Vulcanite scraper & chisel	3.00	Asst.
Wax carvers	5.00- 8.00	1
Wax solvent	3.00	1 can
Waxes...inlay, baseplate, sticky, boxing, utility, beeswax	25.00	Asst.
Whiting	3.00	1
Totals	$ 1,748.05- 1,945.00	

Filling Materials and Supplies

Alloy	$ 250.00- 650.00	20 oz. pkg.
Alloy-mercury proportioner	29.00- 65.00	10 oz.
Base plate wax	3.80- 5.25	1 lb. box
Brush kit	11.45	1
Casting golds	400.00 varies day to day	1 oz.
Gold solders	21.00 varies day to day	1 dwt.

Item	General Price Range	Recommended Minimum Quantity
Cavity lining & varnish	6.00	1 pkg.
Cements		
Calcium hydroxide base	8.75	1 pkg.
Crown & bridge	250.00	30 grams
Filling plastic	12.80- 20.60	2 pow., 1 liq.
Filling porcelain	32.00	3 pow., 1 liq.
Temporary	6.90- 7.75	1 pow., 1 liq.
Resin	34.00	4 pow., 1 liq.
Composite filling material	60.00- 110.00	
Composite resin system	85.00- 150.00	1 kit
Compound sticks	3.75	1 box
Filling porcelain lubricant	2.00	1 tube
Filling porcelain timer	7.00	1
Finishing strips	7.00- 8.70	3 boxes
Glass slab	5.50	1
Gold foil	49.00 varies day to day	1/20 oz.
Gutta percha stopping	4.70	1 box (4 oz.)
Inlay wax	3.35	1 box
Matrix bands	22.35	1 box (100)
Matrix material	4.50	1 roll
Matrix strips (plastic)	1.95	1 box
Matrix retainers	75.00	3
Mercury (price fluctuates widely)	14.00	1 lb.
Mercury dispenser	15.00	1
Pit & fissure sealant	40.00- 60.00	1 kit
Plastic crown forms	15.75	1 box (35)
Spatulas, stainless steel--cement	5.50- 10.00 ea.	2
Squeeze cloths	8.50- 26.60	1 box (500)
Crowns, aluminum temporary, anodized	150.00	1 box (250)
Crowns, polycarbonate	85.00	1 box (100)
Crowns, stainless steel	125.00	1 box (100)
Totals	$ 1,855.55- 2,460.95	

Prosthetic Supplies and Accessories

Alginate	$ 18.50	3 cans
Aluminum shells	28.95	1 box (100 asst.)
Articulator	29.95- 145.00	1
Bite registration frames	97.00	4
Bite registration paste	18.00- 21.00	1 box
Cleaner, impression tray	5.00	1 bottle
Compound heater	110.00	1
Denture reline materials	21.00	1
Denture repair materials	19.10	1
Facings	365.20	Asst. (166)

Item	General Price Range	Recommended Minimum Quantity
Impression paste, crown and bridge	45.00- 75.00	1 kit
Impression paste, full denture	35.00	1
Impression trays, assorted styles as needed		
a. Regular	42.50	Set (6) perforated
b. Partial denture	23.90	Set (4)
c. Full denture	58.40	Set (8)
d. Immediate denture	64.40	Set (8)
Professional denture service unit	230.00	1
Remover, impression paste	3.80	1
Repair resin, self curing	16.50- 18.00	1 lb.
Shade selector	7.50	1
Teeth	200.00- 325.00	Varies
Tray compound	9.75	3 boxes
Tray material, resin	19.25	1 box
Totals	$ 1,468.70- 1,743.25	
Operating Room Supplies		
Anesthetic items:		
Anesthetics (cartridges)	$ 42.50	250
Cartridge syringes (aspirating)	40.00	2
Disposable needles	30.00- 36.00	300
Non-disposable needles	6.60- 9.00	1 doz.ea.Sh.&Lg.
Topical anesthetic	4.50- 8.00	1 pkg.
Burs:		
Carbide burs latch type	100.00	1 asst. (50)
Carbide burs FG	100.00	1 asst. (50)
Carbide burs FG miniature	24.50	1 asst. (10)
Burs, trimming and finishing	8.00- 16.00	1
Plug finishing	5.75- 12.00	1
Angle	4.50	3 asst.
Straight	4.50	3 asst.
Steel		
Angle	32.00	6 doz. asst.
Straight	32.00	6 doz. asst.
Disks & mandrels:		
Separating disks	15.00	2 boxes (100)
Paper disks	8.50	1 box (525) asst.
Plastic disks	13.00- 20.00	1 box asst.
Mandrels, H.P.S.S.	9.00- 12.00	1 doz.
Mandrels, R.A.S.S.	10.80- 13.20	1 doz.
Endodontic items:		
Broaches	13.00	2 doz.
Culture	8.00	12 vials
Drugs	35.00	Varied
Files, sizes 10-45	36.00- 80.00	8 pkg. (6)

Item	General Price Range	Recommended Minimum Quantity
Gutta percha spreaders	21.00- 31.00	Set (3)
Points, paper, gutta percha	11.00- 24.00	1 box (200)
Reamers, sizes 10-45	39.00- 75.00	8 pkg. (6)
Root canal pluggers	22.20- 28.00	3 asst.
Syringe & needles (luer)	9.50	1
Dappen glass, medicament	6.00- 9.00	6
Dental floss, professional refills	7.50	3
Dental floss, patient trial size	24.00- 28.00	1 gross
Hand brush	3.00- 4.50	2
Hand mirror	7.00	1
Handpiece lubricants	22.70	1 set
Equipment cleaner & polish	6.75	1 can
Handcream	4.95	1 bottle
Stones & points, wheels		
Carborundum	8.00	1 set
Diamond	54.00- 66.00	1 set (8)
Totals	$ 829.75- 997.60	
X-Ray Film Processing Equipment and Accessories		
Darkroom timer	$ 31.50	
Developing tank	150.00- 450.00	
Film clips (1 box 12)	25.00	
Film dispenser (1 per operatory)	48.00	
Film hangers	13.75- 19.95	
Film receptacle	30.00	
Intensifying screen & cassette	122.10- 184.45	
Laboratory apron	43.50- 68.00	
Safe light	21.20- 67.75	
X-ray processors		
Intra-oral	800.00- 2,000.00	
Extra-oral	1,275.00- 3,500.00	
Totals	$ 2,560.05- 6,424.65	
X-Ray Supplies and Accessories		
Apron, patient, lead lined	$ 35.00- 60.00	1
Developing & fixing solution	14.20	2 (twin pack)
Solution churns	3.75	1 set
Films, bitewing	34.00	3 boxes (25)
Films, extraoral	16.00	1 box (5x7)
Films, intraoral	64.50	3 boxes (150)
Film filing envelopes	25.00	1 box (500)
Film holders, exposure	5.60	1

Item	General Price Range		Recommended Minimum Quantity
Film mounts	9.25-	45.00	100
Film viewer	35.50-	38.00	1
Rubber gloves	22.50		6
Stain remover	1.50		1 bottle
Totals	$ 266.80-	330.05	
Paper and Cotton Goods			
Absorbent tissue	$ 45.50		1 case (24 boxes)
Cotton applicators, 3"	12.00		1 box (2,000)
Cotton holder	18.30		1
Cotton pellets	3.50-	6.00	1 box
Cotton roll dispenser	9.00		1
Cotton rolls, 1½", med.	17.50-	27.20	1 box (2,000)
Headrest cover	22.50		1 box (250)
Paper bracket table covers	12.50-	21.00	1 box (1,000)
Paper cups	15.50-	24.00	1 case (1,000)
Paper cup dispenser	6.95		1
Paper napkins (patients)	11.50-	18.50	1 case (500)
Totals	$ 174.75-	210.95	

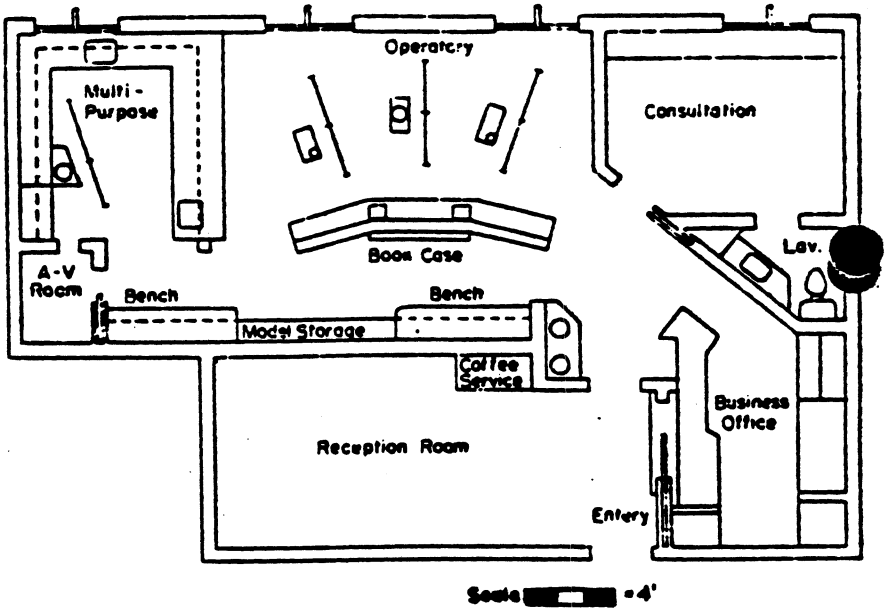
Grand Total Minimum $ 38,763.72
Grand Total Maximum $108,130.77

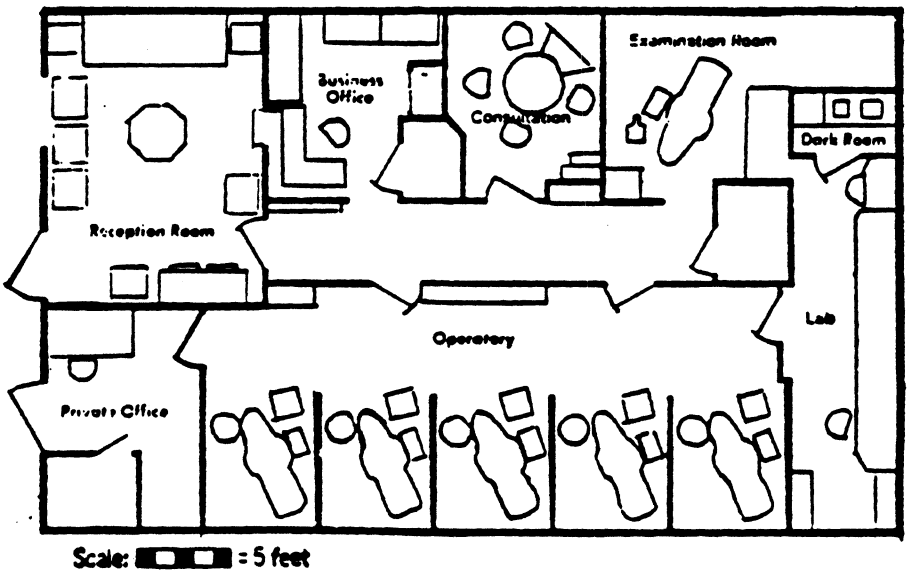
Source: 1987 New Dentist Buying Guide.

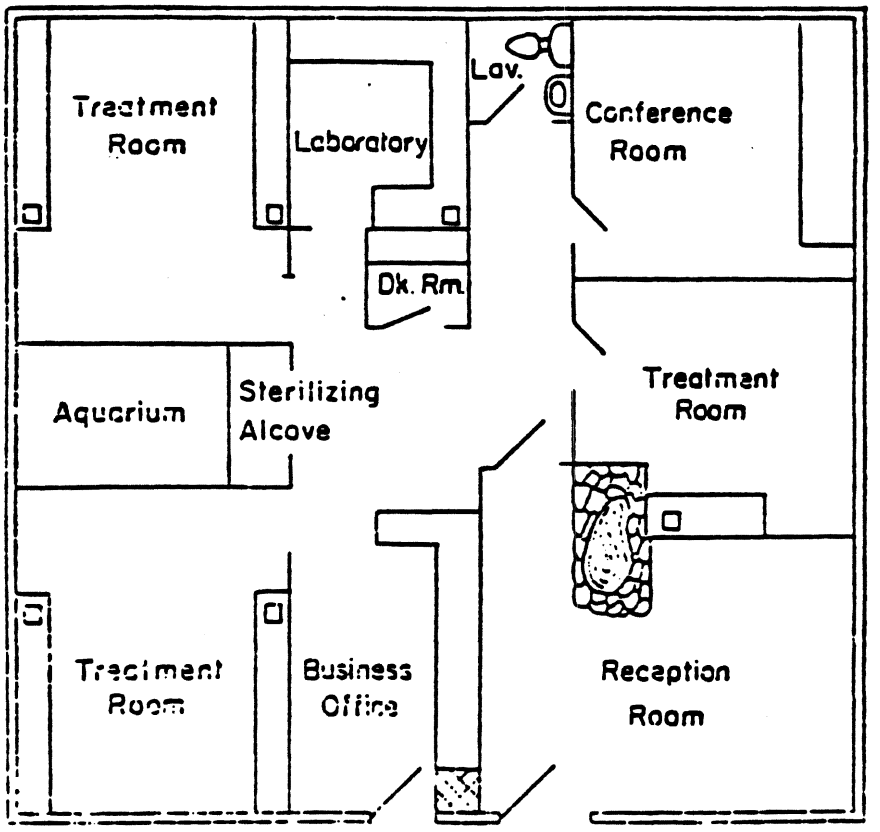
[a]Central gas supply system required at cost of $440.00 - $975.00.

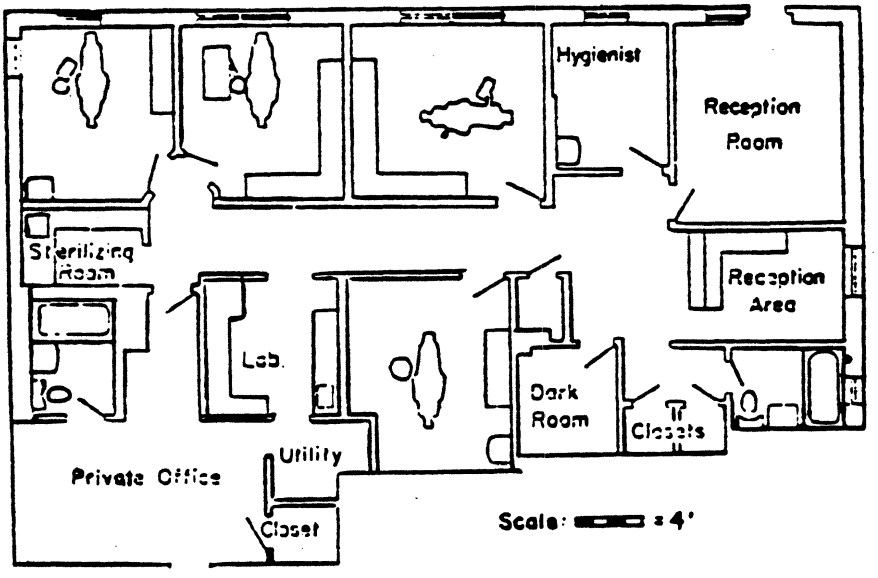
APPENDIX D

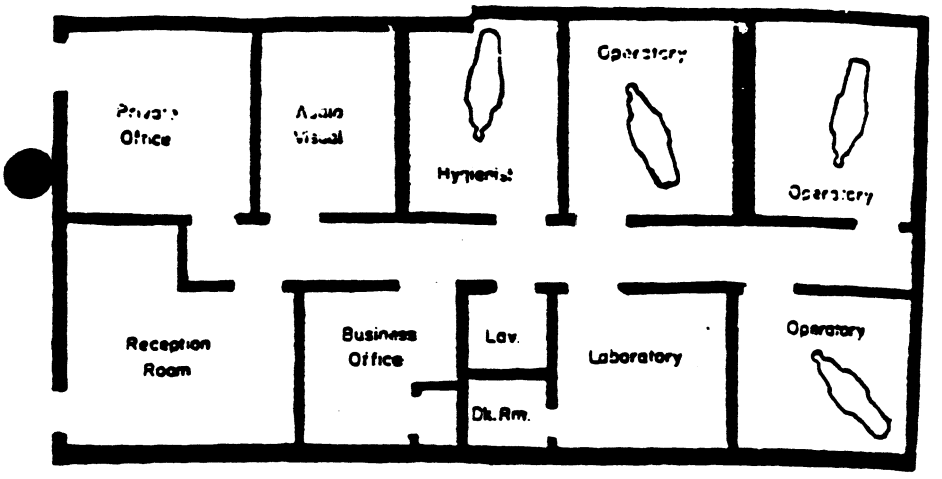
SAMPLE FLOOR PLANS FOR A DENTAL OFFICE

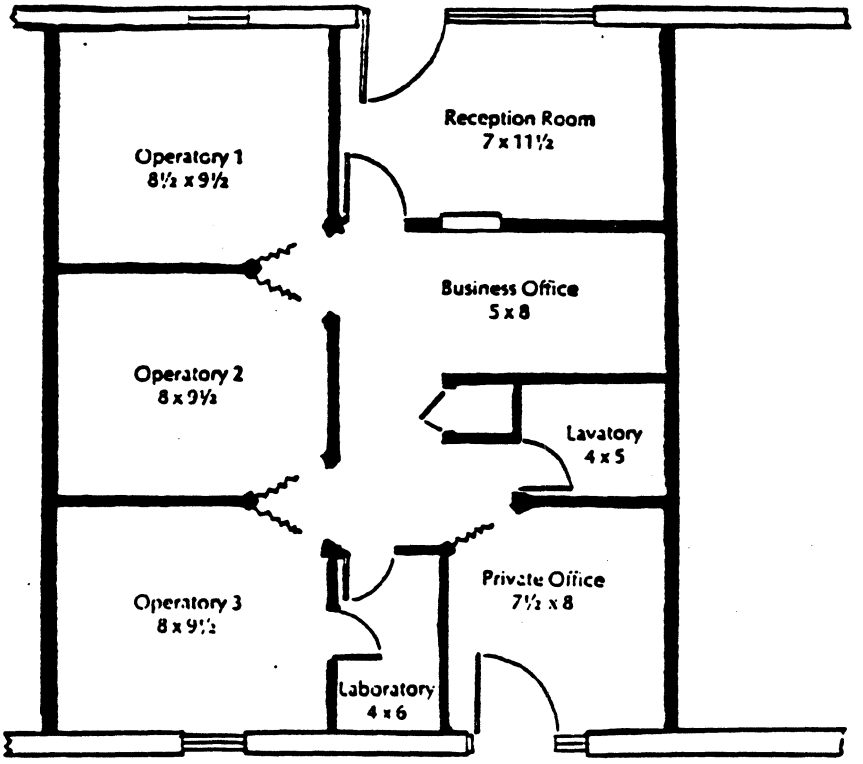

Operatory
Multi-
Purpose
Consultation
Book Case
Lav.
A-V
Room
Bench
Bench
Model Storage
Coffee
Service
Business
Office
Reception Room
Entery
Scale = 4'

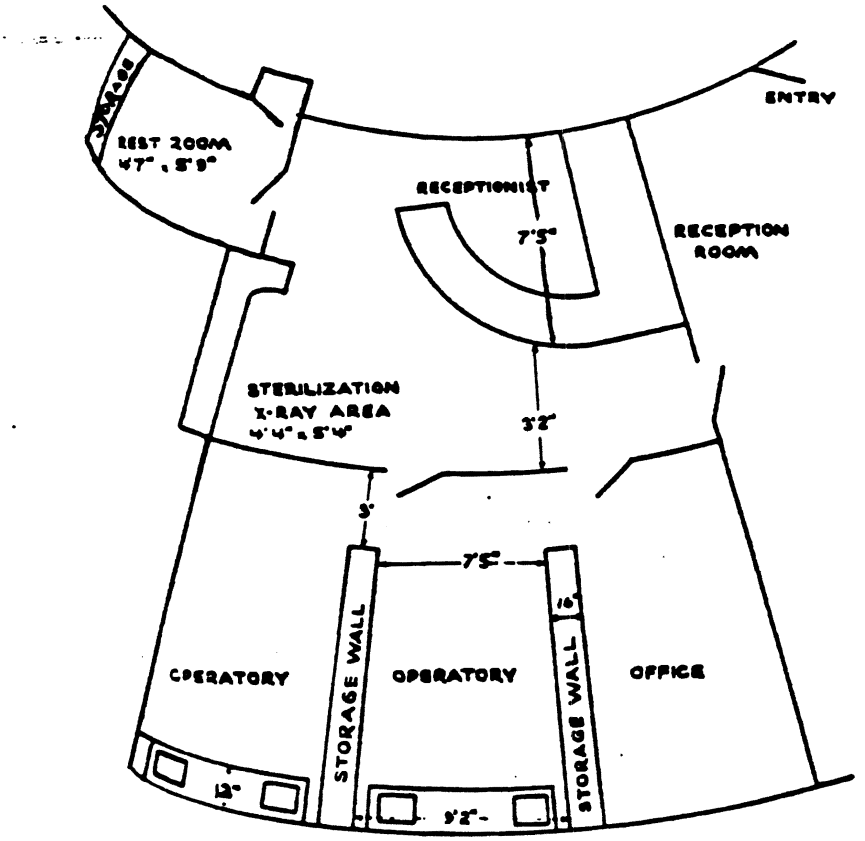

Examination Room
Business
Office
Consultation
Dark Room
Reception Room
Lab
Operatory
Private Office
Scale: = 5 feet

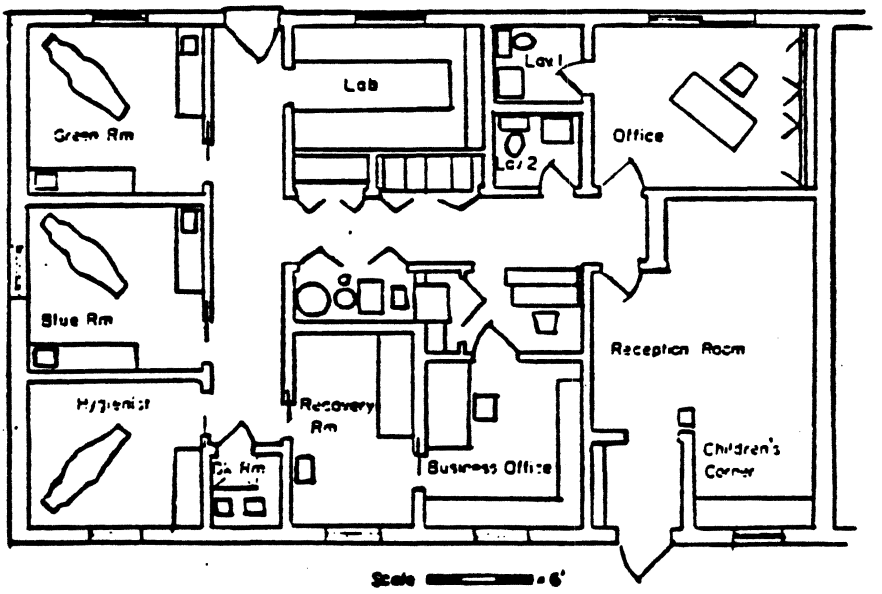

Treatment Room
Laboratory
Lav.
Conference Room
Dk. Rm.
Aquarium
Sterilizing Alcove
Treatment Room
Treatment Room
Business Office
Reception Room

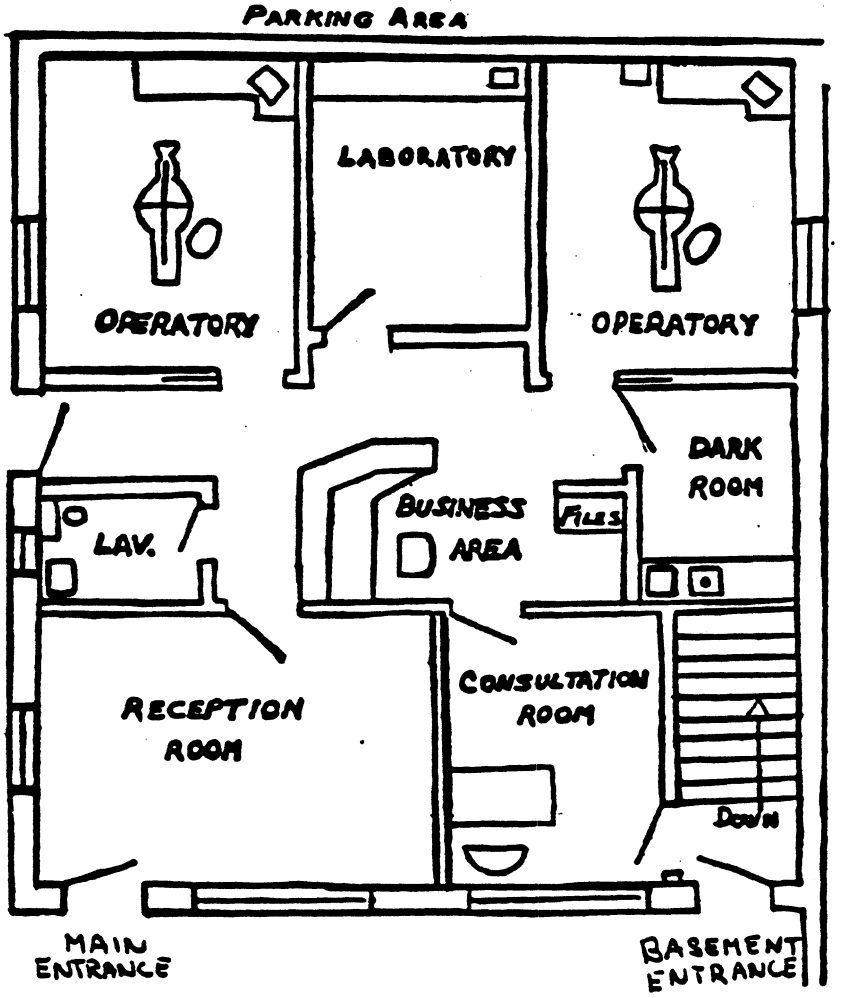

Hygienist
Reception Room
Sterilizing Room
Reception Area
Lab.
Dark Room
Closets
Private Office
Utility
Closet
Scale: = 4'

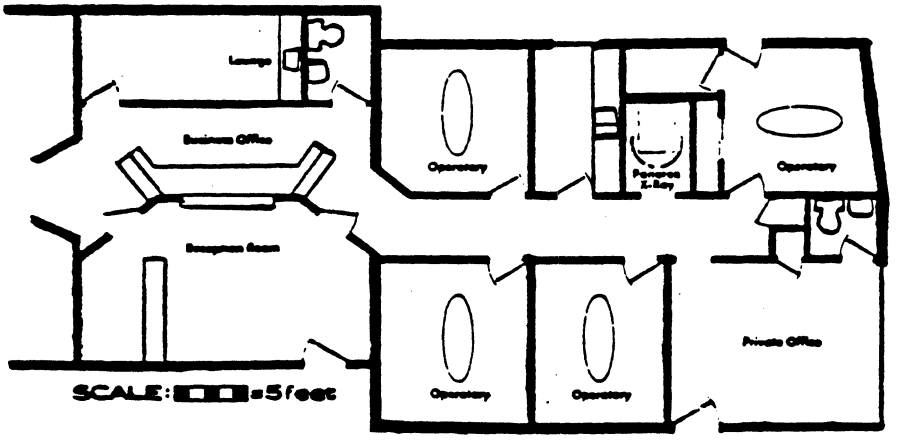

Private Office
Hygienist
Operatory
Operatory
Reception Room
Business Office
Lav.
Dk. Rm.
Laboratory
Operatory

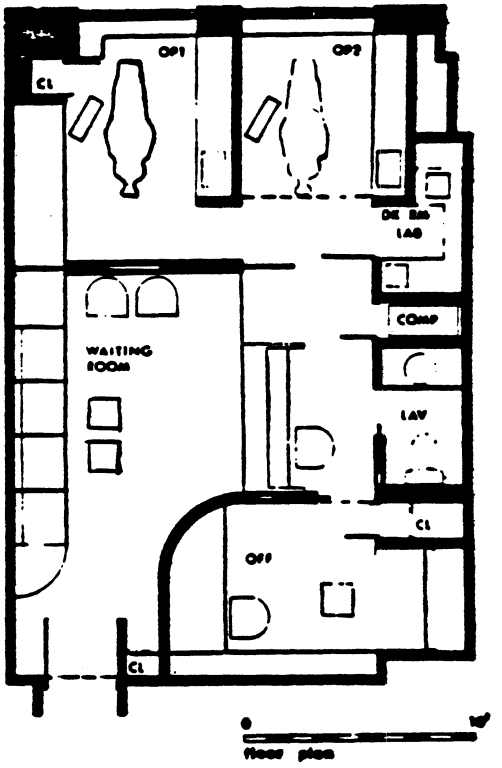

Operatory 1
8½ x 9½
Reception Room
7 x 11½
Business Office
5 x 8
Operatory 2
8 x 9½
Lavatory
4 x 5
Operatory 3
8 x 9½
Private Office
7½ x 8
Laboratory
4 x 6


ENTRY
RECEPTIONIST
7'5"
RECEPTION ROOM
STERILIZATION
X-RAY AREA
5'2"
5'
7'5"
OPERATORY
STORAGE WALL
OPERATORY
STORAGE WALL
OFFICE
13"
9'2"

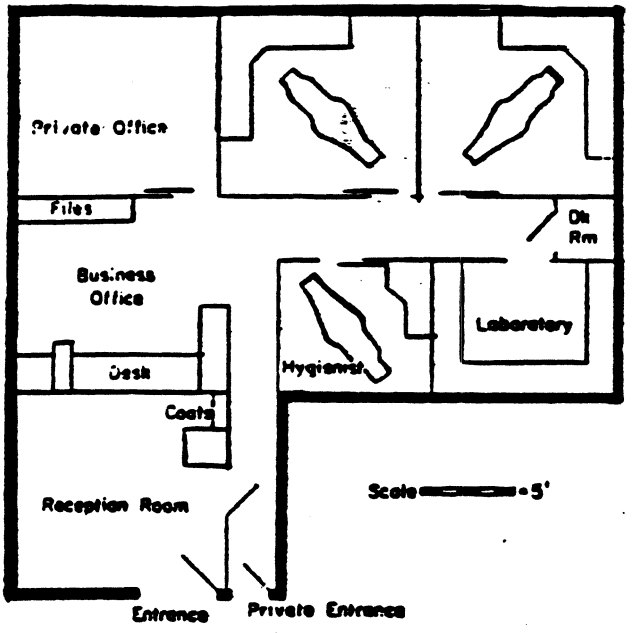

Green Rm
Lab
Lav 1
Lav 2
Office
Blue Rm
Reception Room
Recovery Rm
Business Office
Children's Corner
Scale 6'


PARKING AREA
LABORATORY
OPERATORY
OPERATORY
DARK ROOM
BUSINESS AREA
FILES
LAV.
RECEPTION ROOM
CONSULTATION ROOM
DOWN
MAIN ENTRANCE
BASEMENT ENTRANCE


SCALE: =5 feet


OP1
OP2
CL
DK RM
LAB
COMP
WAITING ROOM
LAV
CL
OFF
CL

floor plan


Private Office
Files
Dk Rm
Business Office
Laboratory
Hygienist
Desk
Coats
Reception Room
Scale 5'
Entrance
Private Entrance

APPENDIX E

CONSTRUCTION COSTS AND CONSUMER PRICE INDICES

TABLE E

CONSTRUCTION COST AND CONSUMER PRICE INDICES

Period	Construction Cost Index[a] (1982=100)	Consumer Price Index[b] (1967=100)
1981	97.0	272.4
1982	100.0	289.1
1983	102.7	298.4
1984	106.3	311.1
1985	109.4	322.2
1986	112.0	328.4
1987	111.1[c]	335.9[c]

[a]Source: U.S. Bureau of Domestic Commerce.

[b]Source: U.S. Bureau of Labor Statistics.

[c]March 1987.

APPENDIX F

AMORTIZATION FACTORS

TABLE F

AMORTIZATION FACTORS

Interest Rate Percent	Years for Repayment						
	10	15	20	25	30	35	40
8	0.149030	0.116830	0.101852	0.093679	0.088827	0.085803	0.083860
9	0.155820	0.124059	0.109546	0.101806	0.097336	0.094636	0.092960
10	0.162745	0.131474	0.117460	0.110168	0.106079	0.103690	0.102259
11	0.169801	0.139065	0.125576	0.118740	0.115025	0.112927	0.111719
12	0.176984	0.146824	0.133879	0.127500	0.124144	0.o22317	0.121304
13	0.184290	0.154742	0.142354	0.136426	0.133411	0.131829	0.130986
14	0.191714	0.162809	0.150986	0.145498	0.142803	0.141442	0.140745
15	0.199252	0.171017	0.159761	0.154699	0.152300	0.151135	0.150562
16	0.206901	0.187822	0.168667	0.164013	0.161886	0.160892	0.160424
17	0.214657	0.187822	0.177690	0.173423	0.171545	0.170701	0.170319
18	0.222515	0.196403	0.186820	0.182919	0.180550	0.180550	0.180240
19	0.230471	0.205092	0.196045	0.192487	0.190432	0.190432	0.190181
20	0.238523	0.213882	0.205357	0.202119	0.200339	0.200339	0.200136

Calculated using the following formula:

$$\text{Amortization Factor} = \frac{i}{(1 - 1+i)-N)}$$

Where i = Interest Rate; N = Number of Years.

APPENDIX G

BLANK FORMS

FORM 1

ESTIMATING THE NUMBER OF ANNUAL DENTAL OFFICE VISITS
BY DEMOGRAPHIC CHARACTERISTICS FOR A SERVICE AREA

Demographic Characteristics	Utilization Rate		Population		Total Number of Dental Visits
All Persons	1.7	x	_____	=	_____
Sex: Male	1.6	x	_____	=	_____
Female	1.8	x	_____	=	_____
				Total	_____
Age: <17	1.6	x	_____	=	_____
17-44	1.7	x	_____	=	_____
45-64	1.8	x	_____	=	_____
65+	1.5	x	_____	=	_____
				Total	_____
		AVERAGE TOTAL ANNUAL NUMBER OF VISITS			_____

FORM 2

AN ESTIMATE OF THE NUMBER OF DENTISTS THE SERVICE AREA CAN SUPPORT

Total Number of Dental Visits Per Year	Results from Rural Oklahoma Dentists Survey: Number of Dental Visits Per Year Per Dentist		Results from Rural Oklahoma Dentists Survey: Total Number of Dentists the Area Can Support	Results from National Survey: Number of Dental Visits Per Year Per Dentist		Results from National Survey: Total Number of Dentists the Area Can Support
Oklahoma						
_____	1,837	Low	_____	3,271	Low	_____
_____	2,948	Average	_____	3,941	Average	_____
_____	4,059	High	_____	5,134	High	_____
National						
_____	1,837	Low	_____	3,271	Low	_____
_____	2,948	Average	_____	3,941	Average	_____
_____	4,059	High	_____	5,134	High	_____

FORM 3

ESTIMATING GROSS INCOME

Number of Visits[a]	Rate Schedule			Revenue		
	High[b]	Average	Low[b]	High	Average	Low
_____	x _____			= _____		
		x _____			= _____	
			x _____			= _____

Source: Oklahoma Survey Data.

[a]Average number of dental office visits per year on a 48 week work year.

[b]Defined as within one standard deviation of the mean.

FORM 4

ESTIMATING EQUIPMENT COSTS

Equipment Type	Number of Items		Price Per Unit (1986) Dollars		Total Cost Dollars
Reception Room					
Chairs, single	_____	x	105.00	=	_____
Magazine rack	_____	x	64.00	=	_____
End table	_____	x	125.00	=	_____
Occasional table	_____	x	129.00	=	_____
Other: _____	_____	x	_____	=	_____
_____	_____	x	_____	=	_____
_____	_____	x	_____	=	_____
Total, Reception Room				=	_____
Business Office					
Calculator/adding machine	_____	x	99.00	=	_____
Chairs, secretarial	_____	x	136.00	=	_____
Copy machine	_____	x	700.00	=	_____
Desk	_____	x	445.00	=	_____
File cabinets	_____	x	275.00	=	_____
Telephone	_____	x	135.00	=	_____
Telephone answering machine	_____	x	200.00	=	_____
Typewriter	_____	x	1,018.00	=	_____
Wastebaskets	_____	x	13.00	=	_____
Business office supplies[a]				=	_____
Other: Computer	_____	x	_____	=	_____
_____	_____	x	_____	=	_____
_____	_____	x	_____	=	_____
Total, Business Office				=	_____
Dentist's Office					
Bookshelf	_____	x	148.00	=	_____
Chair	_____	x	282.00	=	_____
Desk	_____	x	364.00	=	_____
File cabinet	_____	x	100.00	=	_____
Telephone	_____	x	165.00	=	_____
Other: _____	_____	x	_____	=	_____
_____	_____	x	_____	=	_____
_____	_____	x	_____	=	_____
Total, Dentist's Office				=	_____
Operatories					
Assistant stool	_____	x	334.00	=	_____
Autoclave/chemiclave	_____	x	1,260.00	=	_____

FORM 4 (Continued)

Equipment Type	Number of Items		Price Per Unit (1986) Dollars		Total Cost Dollars
Cabinet (portable)	_____	x	812.50	=	_____
Cabinet (modular) group	_____	x	2,466.00	=	_____
Cleaner, autoclave/chemiclave	_____	x	22.50	=	_____
Cleanser, high volume evacuation (1 box)	_____	x	18.00	=	_____
Compressor	_____	x	1,315.00	=	_____
Contra angle (engine drive) (standard or pedo)	_____	x	70.00	=	_____
Contra angle (air)	_____	x	490.00	=	_____
Dental chair	_____	x	2,650.00	=	_____
Dento-dri	_____	x	352.50	=	_____
Dento-drain	_____	x	45.00	=	_____
Electric amalgamator	_____	x	275.00	=	_____
Electrosurg	_____	x	360.00	=	_____
Emergency oxygen unit	_____	x	141.00	=	_____
Oxygen cylinder & contents for above	_____	x	70.00	=	_____
Handpiece (engine driven)	_____	x	302.00	=	_____
Handpiece, straight (air driven)	_____	x	445.00	=	_____
Hydrocolloid conditioner (includes syringes)	_____	x	42.95	=	_____
Instrument sharpener	_____	x	162.50	=	_____
Music system	_____	x	550.00	=	_____
Nitrous oxide sedation unit, central gas system required	_____	x	960.00	=	_____
Operating light bulb (spare)	_____	x	25.00	=	_____
Operating light (unit mounted)	_____	x	679.00	=	_____
or					
Operating light (ceiling mounted, single)	_____	x	783.00	=	_____
Operating instruments & accessories[a]				=	_____
Surgical supplies & accessories[a]				=	_____
Operating room supplies[a]				=	_____
Other: _____	_____	x	_____	=	_____
_____	_____	x	_____	=	_____
_____	_____	x	_____	=	_____
Total, Operatories				=	_____

FORM 4 (Continued)

Equipment Type	Number of Items		Price Per Unit (1986) Dollars		Total Cost Dollars
Laboratory					
Articulators	_____	x	82.50	=	_____
Articulators, adjustable	_____	x	267.00	=	_____
Benches	_____	x	700.00	=	_____
Burnout oven	_____	x	450.00	=	_____
Casting machine	_____	x	287.50	=	_____
Clasp surveyor	_____	x	193.75	=	_____
Dust collector	_____	x	187.50	=	_____
Electric welder (for orthodontic procedures)	_____	x	600.00	=	_____
Fire extinguisher	_____	x	33.00	=	_____
Gas/air torch	_____	x	70.00	=	_____
Gram weight scale	_____	x	52.50	=	_____
Glass measuring graduates, cc.	_____	x	5.83	=	_____
Handpiece, laboratory (belt driven)	_____	x	255.00	=	_____
Laboratory chair (not stool)	_____	x	67.50	=	_____
Laboratory engine (incl. w/ handpiece)	_____	x	443.75	=	_____
Laboratory light (bench)	_____	x	67.00	=	_____
Laboratory stool	_____	x	87.50	=	_____
Laboratory workbench, fireproof, consisting of stainless steel sink; plaster trap; air, gas model trimmer valves	_____	x	1,500.00	=	_____
Lathe	_____	x	182.00	=	_____
Model trimmer	_____	x	307.00	=	_____
Plaster bin	_____	x	150.00	=	_____
Polishing hood w/ removable pan	_____	x	167.50	=	_____
Safety glasses	_____	x	62.50	=	_____
Staining, glazing furnace (opt.)	_____	x	600.00	=	_____
Vacuum investing machine (opt.)	_____	x	350.00	=	_____
Vibrator	_____	x	104.00	=	_____
Work pans, metal or plastic	_____	x	11.00	=	_____
Laboratory supplies & accessories[a]				=	_____
Filling materials & supplies[a]				=	_____
Prosthetic supplies & accessories[a]				=	_____
Other: Paper & cotton goods	_____	x	_____	=	_____
_____	_____	x	_____	=	_____
_____	_____	x	_____	=	_____
Total, Laboratory				=	_____

FORM 4 (Continued)

Equipment Type	Number of Items	Price Per Unit (1986) Dollars	Total Cost Dollars
Darkroom			
Intermediate KV (70 KV)	_____	x 2,640.00 =	_____
or			
High KV (90 KV)	_____	x 4,433.00 =	_____
Darkroom timer	_____	x 10.00 =	_____
Developing tank (temperature regulator)	_____	x 275.00 =	_____
Film clips (1 box 12)	_____	x 24.00 =	_____
Film dispenser (1 per operatory)	_____	x 48.00 =	_____
Film duplicator	_____	x 158.00 =	_____
Film hangers	_____	x 15.00 =	_____
Film projector magnifier[b]	_____	x _____ =	_____
Film receptacle	_____	x 30.00 =	_____
Intensifying screen & cassette	_____	x 110.00 =	_____
Laboratory apron	_____	x 21.00 =	_____
Magni-focuser[b]	_____	x _____ =	_____
Safe light	_____	x 55.00 =	_____
X-ray processor			
Intra-oral	_____	x 2,035.00 =	_____
or			
Extra-oral	_____	x 2,387.50 =	_____
X-ray supplies & accessories		=	_____
Other: _____	_____	x _____ =	_____
_____	_____	x _____ =	_____
_____	_____	x _____ =	_____
			_____
Total, X-Ray/Darkroom		=	_____

Equipment Summary	Total Cost
Reception Room	$_____
Business Office	_____
Dentist's Office	_____
Operatories	_____
Laboratory	_____
Darkroom	_____
	_____
TOTAL COSTS	$_____

Source: Survey Data.

[a]See Appendix C for a detailed listing.
[b]Data not available.

FORM 5

ESTIMATING CAPITAL COSTS

Note: All capital costs must be adjusted to reflect current prices. To do this, calculate adjustments as follows:

$$\text{Capital Items Price Adjustor}^{a} = \frac{(\quad) \text{ Current Construction Cost Index}}{(112.0) \text{ 1986 Construction Cost Index}}$$

I. Building

A. Number of dentists _____
B. Square feet per dentist _____sq. ft.
C. Square feet in building
(Item A x Item B) _____sq. ft.
D. Construction cost per square foot
(Average $55.00/sq. ft.) $_____
E. Construction cost of building
(Item C x Item D) $_____
F. Construction cost adjusted to current price levels
(Item E x _____ capital items price adjustor) $_____

II. Land and Parking Lot
(Locally determined price) $_____

III. Equipment

A. Total equipment costs (Form 4) $_____
B. Equipment costs adjusted to current price levels
(Item A x _____ capital items price adjustor) $_____

---

[a]See Appendix E.

FORM 6

ESTIMATING ANNUAL CAPITAL CHARGES

I. Annual Charge for Building, Land, and Parking

A. Cost of building, land, and parking $_____
(From Form 5, Items I.F and II)
B. Length of loan _____years
C. Interest rate on loan _____percent
D. Amortization factor _____
(From Appendix G, given length of loan and interest rate)
E. Annual capital charge
(Item A x Item D) $_____

II. Annual Capital Charge for Equipment

A. Cost of equipment
(From Form 5, Item III.B) $_____
B. Length of loan _____years
C. Interest rate on loan _____percent
D. Amortization factor _____
(From Appendix G, given length of loan and interest rate)
E. Annual capital charge
(Item A x Item D) $_____

III. Total Annual Capital Charges
(Item I.E + Item II.E) $_____

FORM 7

ESTIMATING ANNUAL OPERATING COSTS

Note: All costs must be adjusted to reflect current prices. To do this, calculate adjustment as follows:

$$\text{Adjustor}^{a} = \frac{(\quad) \text{ Current Consumer Price Index}}{(328.4) \text{ 1986 Consumer Price Index}} = \_\_\_\_\_$$

I. BUILDING

A. Rent (if not purchased)
$\_\_\_\_\_$ (1986 rent) x _____ (price adjustor) = $\_\_\_\_\_$
(Average in Table --)

B. Electricity and Gas
_____/square foot (1986) x _____ square feet x _____ (price adjustor) = $\_\_\_\_\_$

C. Water, Sewer, Trash
_____/dentist (1986) x _____ (price adjustor) = $\_\_\_\_\_$

D. Maintenance
_____/dentist (1986) x _____ (price adjustor) = $\_\_\_\_\_$

E. Janitor
_____/dentist (1986) x _____ (price adjustor) = $\_\_\_\_\_$

F. Taxes
_____/dentist (1986) x _____ (price adjustor) = $\_\_\_\_\_$

G. Insurance (complete one line only)

1. Equipment only
   $_____/dentist (1986) x _____ (price adjustor) = $_____
2. Building and equipment
   $_____/dentist (1986) x _____ (price adjustor) = $_____

H. Other
   $_____/dentist (1986) x _____ (price adjustor) = $_____

I. Total Annual Building Expenses Per Dentist
   (A + B + C + D + E + F + G + H) = $_____

J. Total Annual Building Expenses
   (Item I x _____ number of dentists) = $_____

II. OFFICE

A. Telephone
   $_____/dentist (1986) x _____ (price adjustor) = $_____

B. Office Supplies, Office Equipment and Billing
   $_____/dentist (1986) x _____ (price adjustor) = $_____

C. Fees for Professional Services
   $_____/dentist (1986) x _____ (price adjustor) = $_____

D. Auto Expenses
   $_____/dentist (1986) x _____ (price adjustor) = $_____

E. Conventions
   $_____/dentist (1986) x _____ (price adjustor) = $_____

F. Professional Dues and Licenses
$_____/dentist (1986) x _____ (price adjustor) = $_____

G. Other
$_____/dentist (1986) x _____ (price adjustor) = $_____

H. Total Annual Office Expenses Per Dentist
(A + B + C + D + E + F + G) = $_____

I. Total Annual Office Expenses
(Item H x _____ number of dentists) = $_____

III. Dental

A. Dental Equipment Maintenance
$_____/dentist (1986) x _____ (price adjustor) = $_____

B. Dental Supplies (includes equipment and lab fees)
$_____/dentist (1986) x _____ (price adjustor) = $_____

C. Malpractice Insurance
$_____/dentist (1986) x _____ (price adjustor) = $_____

D. Other
$_____/dentist (1986) x _____ (price adjustor) = $_____

E. Total Annual Dental Expenses Per Dentist
(A + B + C + D) = $_____

F. Total Annual Dental Expenses
(Item E x _____ number of dentists) = $_____

FORM 7 (Continued)

IV. PERSONNEL

Type	1986 Salary	x	Price Adjustor	=	Current Salary	x	Number Employed	=	Total Cost
A. Hygienist	$	x		=	$	x		=	$
B. Dental Assistant	$	x		=	$	x		=	$
C. Receptionist	$	x		=	$	x		=	$
D. Bookkeeper	$	x		=	$	x		=	$
E. Recept./Bookkeeper	$	x		=	$	x		=	$
F. Office Manager	$	x		=	$	x		=	$
G. Bookkeeper/Ofc. Mgr.	$	x		=	$	x		=	$
H. Other	$	x		=	$	x		=	$

I. Total Personnel Costs Without Fringe Benefits
(A + B + C + D + E + F + G + H) = $

J. Fringe Benefits
(.15 x Item I) = $

K. Total Annual Personnel Costs Per Dentist
(L + M) = $

L. Total Annual Personnel Costs
(Item K x _____ number of dentists) = $

[a]See Appendix E.

FORM 8

ESTIMATING TOTAL ANNUAL COSTS

I.	Total Annual Capital Charges (From Form 6, Item III)		$_____
II.	Total Annual Operating Costs		
	A. Building (Form 7, Item I.J)	$_____	
	B. Office (Form 7, Item II.I)	$_____	
	C. Dental (Form 7, Item III.F)	$_____	
	D. Personnel (Form 7, Item IV.L)	$_____	
	E. Total Operating Costs (II.A + II.B + II.C + II.D)		$_____
III.	Total Annual Capital and Operating Costs (Items I + II.E)		$_____

FORM 9

ESTIMATING NET INCOME

	Rate Schedule--Dollars		
	Low	Average	High
I. Gross Income (100% Collection) (From Form 3)			
II. Total Costs (From Form 8, Item III)			
III. Net Income (Item I - Item II)			
IV. Number of Dentists			
V. Net Income Per Dentist (Item III - Item IV)			
VI. Gross Income Given Alternative Collection Rates (Item 1 x Percentage Given			
Collection Rate			
A. 95%			
B. 90%			
C. 85%			
D. 80%			

FORM 9 (Continued)

	Rate Schedule--Dollars		
	Low	Average	High
VII. Net Income Per Dentist Given Alternative Collection Rates (Items VII.A-D ÷ Item IV)			
Collection Rate			
A. 95%			
B. 90%			
C. 85%			
D. 80%			
VIII. Net Income Per Dentist Given Alternative Collection Rates (Item VII.A-D ÷ Item IV)			
Collection Rate			
A. 95%			
B. 90%			
C. 85%			
D. 80%			

FORM 10

ANNUAL REVENUE AND PROFIT (LOSS) FOR A COMMUNITY FROM RENTING A BUILDING TO A DENTIST

I. Annual Cost

A. Capital Costs
(1) Building, Land Parking (Form 6, Item I.E) $_____
(2) Equipment (Form 6, Item II.E) $_____

B. Operating Costs
(1) Building (Form 7, Item I.J) $_____
(2) Other $_____

C. Total Annual Costs (A+B) $_____

II. Annual Revenue and Profit or Subsidy

Sample Monthly Rental Charge Per Dentist	x	Number of Dentists	x	Months	=	Annual Revenue	-	Annual Total Costs (Item I.C)	=	Profit or Subsidy
_____	x	_____	x	_____	=	_____	-	_____	=	_____
_____	x	_____	x	_____	=	_____	-	_____	=	_____
_____	x	_____	x	_____	=	_____	-	_____	=	_____
_____	x	_____	x	_____	=	_____	-	_____	=	_____
_____	x	_____	x	_____	=	_____	-	_____	=	_____
_____	x	_____	x	_____	=	_____	-	_____	=	_____

VITA

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